

National Audubon Society California



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National Audubon Society
Chapters of California

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Lake Almanor
La Purisima
Los Angeles
Madrone
Marble Mountain
Marin
Mendocino Coast
Monterey Peninsula
Morro Coast
Mount Diablo
Mount Shasta Area
Napa-Solano
North Cuesta
Ohlone
Palomar
Palos Verdes/South Bay
Pasadena
Peregrine
Plumas
Pomona Valley
Redbud
Redwood Region
Sacramento
San Bernardino Valley
San Diego
San Fernando Valley
San Joaquin
Santa Barbara
Santa Clara Valley
Santa Monica Bay
Sea and Sage
Sequoia
Sierra Foothills
South Coast
Stanislaus
Tulare County
Ventura
Whittier
Wintu
Yolo
Yosemite Area

Proposal # 2001- H-211 (Office Use Only)

A. PSP Cover Sheet

Proposal Title: Willow Slough Watershed Rangeland Stewardship Program

Applicant Name: National Audubon Society - California

Contact Name: Daniel Taylor, Executive Director

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Amount of funding requested: \$1,800,668

Some entities charge different costs dependent on the source of the funds. If it is different for state or federal funds list below.

State cost _____ Federal cost _____

Cost share partners? ☒ Yes ☐ No

Cost-share estimates include estimates of contributions to the current phase of the program to date, as well as estimates of future contributions to the next phase of the program.

CALFED Bay Delta (Grant #98-E13): \$636,000

U.S.D.A Natural Resources Conservation Service: \$125,000

Yolo Resource Conservation District: \$25,000

California Department of Fish and Game: \$40,000

U.S. Fish and Wildlife Service: \$65,000

U.S.D.A., Agricultural Research Service: \$650,000

California Department of Forestry and Fire Protection: \$25,000

U.S. Army Corps of Engineers: \$5000

U.C. Cooperative Extension: \$8000

Watershed Landowners: \$60,000

National Fish and Wildlife Foundation: \$116,000

Packard Foundation: \$16,000

Michigan State University: \$30,000

U.C. Davis: \$52,000

Indicate the Topic for which you are applying (check only one box):

- ☐ Natural Flow Regimes
- ☐ Beyond the Riparian Corridor
- ☐ Nonnative Invasive Species

Del Norte Sanctuary • California Lake • Del Norte Audubon Center • Los Angeles Education Center
Kern River Preserve • Mayacamas Mountain Sanctuary • McVicar Sanctuary • Richardson Bay Center and Sanctuary
Stanislaus • Paul L. Watts Sanctuary

X Local Watershed Stewardship

- _ Channel Dynamics/Sediment Transport
- _ Environmental Education
- _ Flood Management
- _ Special Status Species Surveys and Studies
- _ Shallow Water Tidal/ Marsh Habitat
- _ Fishery Monitoring, Assessment and Research
- _ Contaminants
- _ Fish Screens

What county or counties is the project located in? Yolo County

What CALFED ecozone is the project located in? See attached list and indicate number. Be as specific as possible. 10.4 Yolo Basin, Willow Slough

Indicate the type of applicant,(check only one box):

- _ State agency
- _ Federal agency
- _ Public/Non-profit joint venture
- X Non-profit**
- _ Local government /district
- _ Tribes
- _ University
- _ Private part y
- _ Other:

Indicate the primary species which the proposal addresses (check all that apply):

- _ San Joaquin and East-side Delta tributaries fall-run chinook salmon
- _ Winter-run chinook salmon
- _ Spring-run chinook salmon
- _ Late-fall run chinook salmon
- _ Fall-run chinook salmon
- _ Delta smelt
- _ Longfin smelt
- _ Splittail
- _ Steelhead t rout
- _ Green sturgeon
- _ Striped bass
- _ White Sturgeon
- _ All chinook species
- X Waterfowl and Shorebirds**
- _ All anadromous salmonids
- X Migratory birds**
- _ American shad
- X Other listed T/E species:** VELB, Swainsons Hawk, California tiger salamander, Western spadefoot toad, Western pond turtle,

Indicate the type of project (check only one box):

- ☐ Research/Monitoring
☐ Watershed Planning
☒ Pilot/Demo Project
☐ Education
☐ Full-scale Implementation

Is this a next-phase of an ongoing project? Yes ☒ No ☐

Have you received funding from CALFED before? Yes ☒ No ☐

If yes, list project title and CALFED number: Union School Slough Watershed Improvement Program (Grant #: 98-E13)

Have you received funding from CVPIA before? Yes ☐ No ☒

If yes, list CVPIA program providing funding, project title and CVPI A number (if applicable): _____

By signing below, the applicant declares the following:

- The truthfulness of all representations in their proposal;
- The individual signing the form is entitled to submit the application on behalf of the applicant (if the applicant is an entity or organization); and
- The person submitting the application has read and understood the conflict of interest and confidentiality discussion in the PSP (Section 2.4) and waives any and all rights to privacy and confidentiality of the proposal on behalf of the applicant, to the extent as provided in the Section.

Daniel Taylor, Executive Director, National Audubon Society - California

Printed name of applicant


Signature of applicant:
Signature of applicant:

B. Executive Summary

Title of Project: Willow Slough Watershed Rangeland Stewardship Program

Amount Requested \$1,800,668 **Applicant Name:** National Audubon Society – California

Address: 555 Audubon Place, Sacramento, CA 95825 **Phone:** (916) 481-5332 **FAX** (916) 481-6228

E-mail of Primary Contact(s): dtaylor@audubon.com

Participants and Collaborators: Rangeland landowners of Willow Slough Watershed, Yolo County Resource Conservation Service, Natural Resources Conservation Service, Michigan State University, U.C. Cooperative Extension, University of California at Davis, USDA Agricultural Research Service.

Project Location: Inner Coast Range foothills of the Willow Slough Watershed, Yolo County.

Project Objectives: To develop an expanded watershed stewardship program to enhance and restore riparian and grassland habitats, improve forage quality, improve water quality and reduce erosion.

Approach: To build on existing relationships with ranchers forged through our previous CALFED contract to implement recommendations of the Willow Slough Integrated Resources Management Plan, while expanding research and monitoring efforts to 1) test the assumptions on which watershed objectives are based and 2) provide environmental and economic data to allow an adaptive management approach.

Hypotheses: Together with our research subcontractors, we will test or evaluate a total of 36 hypotheses derived from the assumptions upon which Willow Slough watershed objectives are based—and which form the main tenets of this project's conceptual model. These are that: 1) successful implementation of conservation and restoration practices is best achieved through a community-based watershed stewardship program; and 2) conservation and restoration practices on *individual* farms and ranches will increase biodiversity and quality habitat for wildlife, improve water quality, control invasive non-native plants, and sustain the economic conditions for agriculture. The individual hypotheses are listed in Tables 2 and 3.

Uncertainties Involved: This project addresses ERPP uncertainties related to "Beyond the Riparian Corridor" by focusing on agricultural (rangeland) conservation and wildlife-friendly rangeland practices.

Expected Outcomes: **1.** An ongoing, landowner-driven, rangeland stewardship group, **2.** At least 2 ranch-wide conservation plans, including prescribed grazing plans; **3.** Implementation of conservation and restoration activities, including: 1200 acres of prescribed burning, restoration of 200 acres of native perennial grassland, 3 miles of riparian fencing and revegetation, erosion control demonstration projects using bioengineering, and enhancement of stock ponds for wildlife; **4.** Assessment of range and habitat condition and species distribution using remote sensing technology; **5.** A web-based decision-support tool for landowners **6.** Identification and assessment of resource needs for rangeland stewardship, including conservation easements, restoration loan funds, and a working "grassbank"; **7.** Research and monitoring on a) the palatability and nutritional value of native perennial grasses; b) effectiveness of grassland restoration techniques; c) soil, plant, and avian response to grassland and riparian restoration projects; and d) factors that influence landowner participation in watershed stewardship.

Applicability to CALFED ERP Goals: **1.** achieve the recovery of at-risk native species, by improving habitat values in rangelands (grassland and riparian areas) for migratory birds, the valley elderberry longhorn beetle, California Swainson's hawk, California tiger salamander, western spadefoot toad, western pond turtle, giant garter snake; **3.** maintain and enhance populations of selected species for sustainable commercial and recreational harvest, by improving habitat values for Central Valley upland game species and migratory waterfowl; **4.** restore functional habitat types, especially riparian and perennial grassland habitats on rangelands for public values; **5.** reduce the negative biological and economic impacts of non-native species on riparian and grassland habitats; and **6.** improve and maintain water quality by reducing erosion on rangeland and sediment delivery to watershed waterways.

C. Project Description

1. Statement of the Problem

a. Problem

The Willow Slough watershed is an important contributor to the health of the Bay-Delta ecosystem (ERPP, VII. pp. 341-353). In 1996, the Willow Slough Watershed Integrated Resources Management Plan (Willow Slough Plan) identified three major categories of natural resource problems within this 131,000-acre watershed, including: 1) lack of biodiversity and quality habitat for wildlife as a result of conventional land management practices; 2) degradation of water quality through sediment and nutrient loading; and 3) the resulting threats to agricultural sustainability in the region. Rangeland resources have been degraded by more than 100 years of intensive sheep and cattle grazing and poor land management practices that have reduced diversity of plant species and cover, reduced infiltration and increased rainfall run-off, accelerated erosion, and degraded riparian habitats. Intensive farming practices have degraded water quality, severely reduced important riparian and wetland habitats, and increased flooding problems. The Plan further recognized that the upper and lower watershed resource problems are intimately tied to one another, so that only an integrated approach to managing watershed resources can improve overall ecological health.

The Willow Slough Plan (Jones & Stokes, 1996) came out of a two-year planning process with local landowners initiated by the Yolo County Resource Conservation District (Yolo RCD), Yolo County Flood Control and Water Conservation District, Yolo County Community Development Agency, and the California Wildlife Conservation Board. In 1998, Audubon-California teamed up with the Yolo RCD to initiate a focused effort to implement the recommendations of the Plan in the Union School Slough watershed, a subwatershed of Willow Slough. This CALFED-funded effort, now entering its second year, has been well-received in the region and has achieved many of its initial goals (see Appendix 1).

Nevertheless, the scope of the resource issues in the watershed demands that we expand our efforts. Together, Audubon-California and the Yolo RCD are proposing complementary projects for the upper and lower watersheds, respectively, that 1) build on momentum and the lessons learned through the Union School Slough Watershed Improvement Program (USSWIP); 2) build on the RCD's implementation and monitoring efforts during the previous 5 years; 3) initiate systematic efforts to assess the contribution of restoration and conservation activities to overall watershed health. This data-driven approach, undertaken together with our farm- and ranch-owner participants, will provide needed information to feed back into an adaptive management program. It will also provide effective models for partnering with agriculture, the largest resource user in the Bay Delta system.

b. Conceptual model

"Integrated resources management is a synthesis of science and technology with values and ethics" (Willow Slough Plan, p. 4-1). The Willow Slough Plan is based in two over-arching tenets that Audubon-California has adopted as the conceptual model for this program.

Tenet 1. Successful implementation of conservation and restoration practices is best achieved through a community-based watershed stewardship program with voluntary participation by landowners. ***"Participation in the development, implementation and monitoring of watershed management activities by local landowners and other watershed stakeholders, including government agencies and academic institutions is essential to effective long-term land stewardship"*** (ERPP 2001 Implementation Plan, Proposal Solicitation Package, p 39.) The philosophy behind the Willow Slough Plan is that farmers and ranchers are the key players in local solutions to watershed problems. Yet, more

often than not, the very landowners upon whom stewardship responsibility rests lack the time, resources, and expertise to get the job done.

Our efforts to build a community-based program through the USSWIP have centered on involving landowners in group and individual meetings; providing them with technical and financial assistance in planning, permitting, designing, implementing, and managing conservation projects; and offering training workshops to disseminate practical and technical information on relevant conservation and restoration techniques. Our assumption is that these approaches will increase farmers' and ranchers' awareness, knowledge and appreciation of natural resources, and therefore their interest in and capacity for implementing conservation and restoration activities. Yet, little information is available on the effectiveness of these approaches. Audubon is now proposing to systematically evaluate the outreach and educational efforts at the same time that we will test hypotheses related to the ecological impact of the actual conservation and restoration activities that result from them (Tenet #2 of our conceptual model, below). We believe that this is the first watershed program that embraces this dual evaluation approach.

Tenet 2. Conservation and restoration practices on *individual* farms and ranches will increase biodiversity and quality habitat for wildlife, improve water quality, control invasive non-native plants, and sustain the economic conditions for agriculture. *“Important questions remain about how agricultural practices can be enhanced or modified to improve ecological conditions and species health”* (ERPP 2001 Implementation Plan, PSP, p. 38.). Many of the conservation and restoration activities carried out on agricultural lands in the watershed to date are based on general assumptions regarding their contribution to improving ecological and economic conditions (see Table 1). Audubon's goal here is to evaluate many of these assumptions as they relate to the upper watershed. Together with our research subcontractors, we will test a series of hypotheses detailed in Table 3.

c. Hypotheses being tested

Tables 2 and 3, respectively, present the hypotheses that are derived from the two key tenets of our conceptual model, and the program activity (subtask) with which they are associated. The tables also identify the methods to be used to test or evaluate each hypothesis and the CALFED ERP goals and/or uncertainties that each activity addresses.

d. Adaptive Management

Figure 1 illustrates the adaptive management program that has been adopted for this program. It builds on work that began many years ago through the development of the Willow Slough Plan. The Plan and those who shaped it identified problems and management objectives based on available information, the experience of stakeholders, and a general understanding of how the watershed ecosystem functions and how it has been altered. The process also evaluated opportunities and constraints for improving resource management and watershed conditions. These were the *first* critical steps in an adaptive management process. Through the USSWIP, Audubon and the Yolo RCD then undertook a set of pilot or demonstration projects in a subwatershed. Rangeland projects include: 1) fencing and replanting riparian areas; 2) prescribed burning to eliminate noxious weeds, restore grasslands, and improve forage; 3) reseeding with native perennial grasses; and 4) enhancing habitat on stock ponds. Existing literature establishes that these types of activities undertaken elsewhere have improved riparian and grassland habitats, reduced damage to riparian areas from grazing livestock, improved water quality, increased biodiversity, reduced invasions of noxious weeds, and improved forage quality (Anderson 1999, Barrows et al. 1998, Chaney, et al. 1993, DiTomaso et al. 1999, Menke 1980, The Nature Conservancy 1999, USDI 1997, Wirka 1999, Wood 2000, Wrysinki et al. 1998). Indeed, we believe that enough evidence exists to continue with implementation of these activities on a larger scale. However, our ability to build

Table 1. General assumptions regarding the contribution of conservation and restoration practices towards watershed management objectives.

	Watershed Man:		Management Objectives	
	Increases biodiversity and quality habitat for wildlife by ...	Improves water quality by..	Controls invasive non-native plants by ...	Sustains economic conditions for agriculture by...
Rangeland Conservation Practices				
Fencing riparian areas and revegetating with native of riparian corridors (Subtask 2.1)	..increasing forage, nesting and cover quality of riparian and grassland habitats for greater diversity and abundance of wildlife species.	..reducing nutrient and sediment loading to streams by minimizing trampling of stream banks and defecation in riparian corridors.	..reducing weed infestations though appropriately timed grazing of riparian corridor.	..improving property values by managing valuable aesthetic and natural resource. ..maintaining and enhancing populations of wildlife species for sustainable commercial and recreational harvest
Prescribed burning (Subtask 2.2)	..increasing forage diversity and availability throughout the year and improving habitat values of nesting and cover for grassland wildlife species.	..promoting native perennial grasslands which improve infiltration and groundwater recharge.	..reducing annual weed infestations in rangelands and promoting existing populations of native perennial grasses.	..improving forage quality and quantity for livestock grazing.
Native perennial grassland restoration (Subtask 2.3)	..increasing forage diversity and availability throughout the year and improving habitat values of nesting and cover for grassland wildlife species.	..reducing erosion from rangeland by increasing water percolation as a result of deep-rooted perennial grasses.	..suppressing annual weed infestations in rangelands and establishing populations of native perennial grasses.	..extending the length of the forage season for livestock grazing. ...maintaining and enhancing populations of wildlife species for sustainable commercial and recreational harvest
Fencing and planting stock ponds and provision of off-pond watering system (Subtask 2.4)	..increasing forage, nesting, and cover quality of riparian and grassland habitats for greater diversity and abundance of wildlife species.	..reducing nutrient and sediment loading to streams by minimizing trampling of banks and defecation into streams.	..reducing weed infestations though appropriately timed grazing within stock pond area.	..providing clean and dependable source of drinking water for livestock. ..maintaining and enhancing populations of wildlife species for sustainable commercial and recreational harvest.
Gully and streambank stabilization using biotechnical materials (Subtask 2.5)	..increasing forage, nesting, and cover of riparian habitats for greater diversity and abundance of wildlife species.	..reducing erosion and sediment loading to streams from rangeland.		

Goal and/or Uncertainty		approach
Uncertainty: Beyond the Riparian Comdor Other topic areas: Local Watershed Stewardship, Environmental Education	H1.1 Land manager voluntary participation in conservation activities will be enhanced through regular contact with other watershed stewards	Landowner sur
Uncertainty: Beyond the Riparian Corridor Other topic areas: Local Watershed Stewardship, Environmental Education	H1.2 Landowner participation in conservation activities will be enhanced by providing whole ranch conservation planning service that addresses multiple resource issues	Landowner sur
Uncertainty: Beyond the Riparian Corridor Other topic areas: Local Watershed Stewardship, Environmental Education	H1.3.1 Land manager applications for existing cost-share programs for habitat enhancement and conservation (e.g. NRCS , WCB, USFWS) will increase in the watershed when facilitated by third-party technical assistance	Landowner sur Tracking of co
	H1.3.2 Land manager applications for existing cost-share funding would be enhanced by the availability of low-interest funds to provide “bridge” loans for initial capital outlays while landowners are awaiting reimbursement from cost-share agencies.	Landowner sur
	H1.3.3 Land manager voluntary participation in conservation activities will be enhanced by the possibility of selling conservation easements for their properties	Landowner sur
Uncertainty: Beyond the Riparian Corridor Other topic area: Local Watershed Stewardship	H1.4 The availability of reserved forage that may be accessed while resting or restoring portions of their working range will increase landowners’ willingness to participate in prescribed burning or other restoration activity	Landowner sur
Uncertainty: Beyond the Riparian Corridor Other topic areas: Local Watershed Stewardship, Environmental Education	H1.5.1 Land manager voluntary participation in conservation activities will be enhanced through participation in training workshops that provide practical and technical information on relevant conservation topics	Landowner sur
	H1.5.2 Providing land managers with regular, near-real-time spatial analyses of vegetation properties will enhance their ability to use adaptive management for conservation and rangeland goals	Landowner sur
	H1.5.3 Providing land managers with information regarding the cost of implementing conservation activities will enhance their ability to use adaptive management for conservation and rangeland gods	Landowner sur Cost assessmen
	H1.5.4 Ranchers’ willingness to try reseeding with native perennial grasses will be increased by the availability of data confirming the forage quality and palatability of native grass species in the watershed	Landowner sur Forage quality results (Subtas

Goal and/or Uncertainty		methodology
Goal 1. At-risk native species	H2.1.1 Fencing riparian areas from livestock will increase cover of riparian vegetation generally and increase cover of native species, even areas that are not revegetated	Quantitative ve Remote sensing
Goal 3. Harvestable species	H.2.1.3 Restoration practices will increase avian species richness and density within the restored riparian systems	Avian point co
Goal 4. Habitats	H.2.1.4 Within the restored riparian areas, the avian community composition will shift from generalist to riparian specialist bird species as the system approaches reference conditions	Avian point co
Goal 5. Non-native invasive species.	H2.1.5 Willows and cottonwoods can be successfully established in upland riparian corridors, even in those where riparian tree species have been eradicated by livestock	Qualitative cen 3.1)
Goal 6. Sediment and water quality	H2.1.6 Well-timed and limited introduction of grazing animals into fenced riparian areas can provide valuable forage and weed control while minimizing damage to riparian vegetation	Qualitative cen 3.1) Remote sensing
Uncertainty: Beyond the Riparian Corridor	H2.1.7 Fencing riparian areas from livestock will improve water quality	This hypothesi related project
Goal 1. At-risk native species	H2.2.1 Cover of medusahead and star thistle in heavily infested rangeland units will be reduced after well-timed prescribed fire in the spring	Quantitative ve Remote sensing
Goal 3. Harvestable species		
Goal 4. Habitats		
Goal 5. Non-native invasive species.	H2.2.2 Cover of native perennial grasses will increase in prescribed fire units in which populations natives occur prior to the burn (Conversely, fire alone will not increase native perennial cover in units in which natives are not present before the burn)	Quantitative ve Remote sensing
Uncertainties: Beyond the Riparian Corridor, Non-native Invasive Species		

Goal 3. Harvestable species	H2.3.2 Cover and density of individual native grass species will vary by pre- and post-planting management techniques	Quantitative vegetation
Goal 4. Habitats		
Goal 5. Non-native invasive species.	H2.3.3 Sites with locally severe infestations of particularly intractable invasives will experience less restoration success than adjacent sites	Quantitative vegetation
Uncertainties: Beyond the Riparian Corridor, Non-native Invasive Species	H2.3.4 Introduction of native forbs will increase plant community productivity (cover) and diversity	Planting experiment block design (subtask 3.4)
	H2.3.5 Species diversity will be greater and vegetative cover will be more stable in treatments where native forbs are seeded after two years of broadleaf herbicide application, as compared to seeding the forbs at the same time as the grasses	Planting experiment block design (subtask 3.4)
	H2.3.6 Plots where both native forbs and perennial grasses have established will contain significantly less cover of exotic weeds than plots where both these species have not established	Planting experiment block design (subtask 3.4)
	H2.3.7 Forage value of native perennial grasses and nonnative annual grasses will vary seasonally and by species, but cumulative forage value of native grasses will be higher for native perennial species than annuals	Laboratory analysis of samples collected
	H2.3.8 Grazing animal selectivity will not favor individual native grass species or types of grasses (native versus perennial)	Forage behavior (subtask 3.4) Fecal analysis (subtask 3.4)
	H2.3.9 Diversity and abundance of upland bird species will be increased in the restored perennial grasslands compared to areas dominated by nonnative annual grasses	Avian point count structure (subtask 3.6)
	H2.3.10 Perennial grassland restoration practices will increase avian species richness and density in the restored areas, and there will be a shift from generalist to grassland specialist species as the system approaches reference conditions	Avian point count structure (subtask 3.6)
	H.2.3.11 Brush piles and perches will increase bird use, abundance and species composition by providing cover, foraging perches, and nesting habitat	Avian point count structure (subtask 3.6)
	H2.3.12 Within the restored areas, the diversity and abundance of grassland specialist species will be greater in more successful restoration than less successful sites	Avian point count structure and composition (subtask 3.6)
	H2.3.13 Rangeland restoration using deep-rooted native perennial grasses will improve soil water percolation and retention, reduce soil compaction, enhance nutrient use efficiency, and ensure vigorous re-growth compared to annual grassland systems	Replicated laboratory measure N and retention and N evaluation for N accumulation. nitrate-N and a (subtask 3.6)
	H2.3.14 Establishment of native perennial grasses will result in a reduction in the annual weed seed bank over time	Soil weed seed bank (subtask 3.6)

Goal 3. Harvestable species	revegetate	
Goal 4. Habitats		
Goal 5. Non-native invasive species.	H2. Well-timed and limited introduction of grazing animals into fenced pond areas can provide valuable forage and weed control while minimizing damage to riparian vegetation	Quantitative and qualitative vegetation analysis (subtask 3.1)
Goal 6. Sediment and water quality		
Uncertainty: Beyond the Riparian Corridor		
Goal 6. Sediment and water quality	H1. Small scale stabilization projects using biotechnology will reduce erosion in rangeland gullies	Erosion pin monitoring (Subtask 3.1)
Uncertainty: Beyond the Riparian Comdor		

2. Goals and Objectives (identified in WS Plan)

1. Increase biodiversity and quality habitat for wildlife
2. Improve water quality
3. Control invasive non-native plants
4. Sustain economic conditions for agriculture

3. Conceptual Model

Tenet 1.

Successful implementation of conservation and restoration practices is best achieved through a community-based watershed stewardship program with voluntary participation by landowners.

Tenet 2.

Conservation and restoration practices on **individual** farms and ranches will increase biodiversity and quality habitat for wildlife, improve water quality, and control invasive non-native plants, and sustain the economic conditions for agriculture.

Undertake **pilot/demonstration** projects related to
Tenet 1 of Conceptual Model

Undertake pilot/demonstration projects related to
Tenet 2 of Conceptual Model

4. Restoration Actions

Task 1. Landowner outreach, education, and project planning

Subtask 1.1 Establishment of rangeland stewardship group

Subtask 1.2 Whole ranch conservation plans and individual project planning

Subtask 1.3 Resource development and capacity building

Subtask 1.4 Grass bank feasibility study

Subtask 1.5 Landowner training workshops

Task 2. Implementation of conservation restoration activities

Subtask 2.1 Riparian fencing and revegetation

Subtask 2.2 Prescribed burning

Subtask 2.3 Native perennial grassland restoration

Subtask 2.4 Stock pond enhancement for water quality

Subtask 2.5 Control of gully erosion with bioengineering

Test hypotheses related to
Tenet 1 of Conceptual Model
(See Table 2)

Test hypotheses related to
Tenet 2 of Conceptual Model
(See Table 3)

5. Monitoring

Task 3 Research, assessment and monitoring

Subtask 3.1 Ground-based monitoring of vegetation response to conservation and restoration activities

Subtask 3.2 Rangeland monitoring and analyses using GIS and remote sensing technology (MSU subcontract- Qi and Malmstrom)

on these efforts has in part been limited by our current lack of funding to assess and monitor our initial projects. This proposal will close that gap in the adaptive management process by initiating systematic assessment and monitoring efforts.

2. Proposed Scope of Work

a. Location and/or Geographic Boundaries of the Project

The project is located in Yolo County, Ecozone 10.4 Yolo Basin, Willow Slough. Figure 2 is a location map showing the entire watershed. The watershed includes the steep eastern slope and low-lying foothills of the inner Coast Ranges and the relatively flat alluvial plain of the southern Sacramento Valley. Figure 3 is a map showing the Willow Slough upper watershed rangelands (project boundary and geographic coordinates) on a USGS quadrangle basemap. The program area encompasses all privately-owned ranches from the western watershed boundary to the Winters Canal at the base of the foothills.

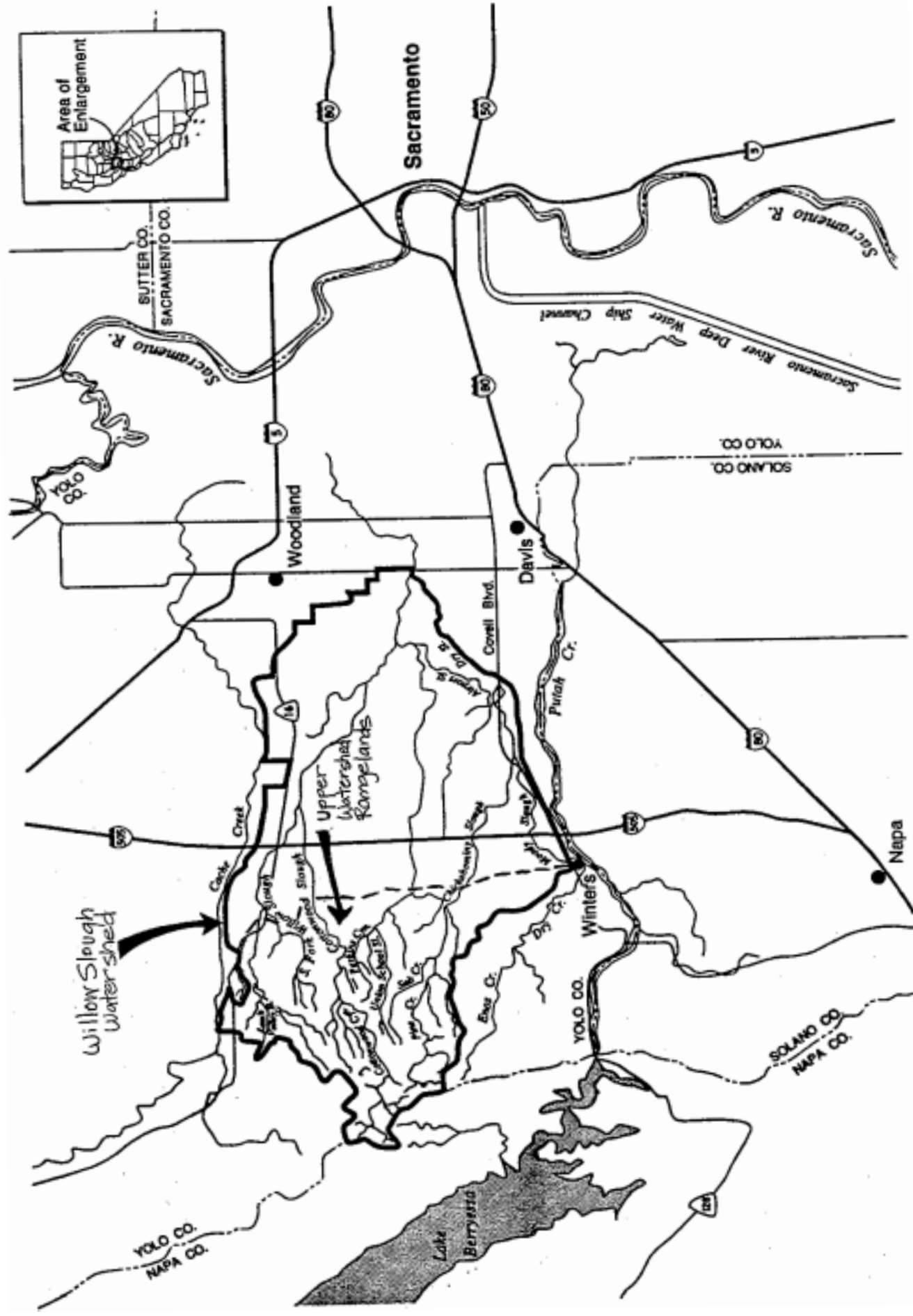
b. Approach

The proposal develops an expanded watershed stewardship program that builds on existing relationships with ranchers forged through the USSWIP. It also expands research and monitoring efforts to: 1) test the assumptions on which watershed objectives are based and 2) provide environmental and economic data to allow an adaptive management approach. The program is organized into three tasks: landowner outreach, education, and project planning (Task 1), implementation of restoration and conservation activities (Task 2), and research, assessment and monitoring (Task 3). Program Management is included as a separate and final task (Task 4). Although each is described discretely below, it should be noted that all three tasks are closely integrated, as indicated in Figure 1 and Tables 1, 2 and 3. Tasks 1 and 2 will be carried out primarily by Audubon-California staff, working with participating landowners, the Yolo RCD and participating agencies. Five of the 8 subtasks in Task 3, however, will be subcontracted to research institutions. General information about the proposed approaches and methodologies for these subcontracted research tasks is included below, but detailed workplans are relegated to Appendix 2. The schedule and primary outcomes for each task and subtask are contained in Table 4.

Task 1. Landowner outreach, education, and project planning

Subtask 1.1 Establishment of a rangeland stewardship group. During the first year of the USSWIP, Audubon established a presence in the watershed by getting to know individual landowners and their families, implementing successful demonstration projects, and delivering on cost-share funding opportunities. We learned that while communication and coordination among landowners, agencies and other watershed stakeholders is a prerequisite of success, large meetings of watershed participants is not. While it is important that individual landowners feel that they are part of a larger effort, it is more important that they feel like their individual needs and concerns are being heard. Therefore, our proposed rangeland stewardship group will rely less on whole-group meetings, and more on individual outreach. The first step will be an in-depth landowner survey and one-on-one meetings and site tours. From these we will develop a rangeland improvement priority list and research agenda.

Subtask 1.2. Whole ranch conservation plans and individual project planning. Project staff will work with landowners to develop comprehensive whole-ranch conservation plans as well as individual project plans. Conservation plans will identify priority areas and practices for implementation and management on a long-term basis (beyond the scope of this grant). Practices may include prescribed fire, controlled grazing, reseeding, targeted weed control, riparian fencing and restoration, habitat enhancements, water development, stock pond habitat enhancements, erosion control projects, “eco-tourism” opportunities,



Jones & Stokes Associates, Inc.

Location Map of the Willow Slough Watershed

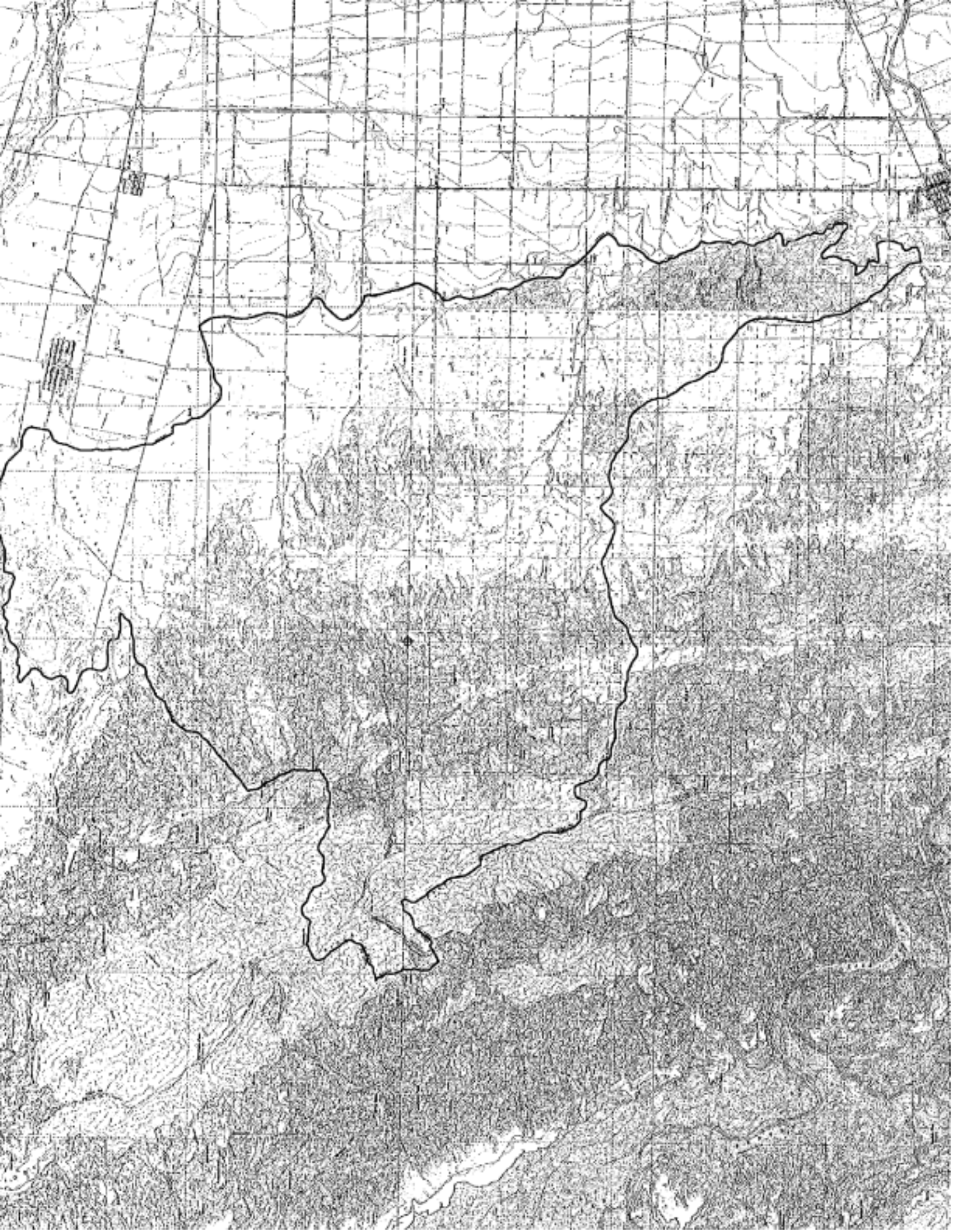


Table 4. Program Outcomes and Annual Schedule

TASK	YEAR ONE	YEAR TWO	YEAR THREE
Program management	<ul style="list-style-type: none">• Hire (first year) and manage program staff• Establish subcontractor agreements (first year), coordinate subcontract progress with Principal Investigators, and review of subcontractor annual and final reports• Conduct monthly coordination and information dissemination meetings between Auduhon, Yolo RCD staff, and other program participants• Prepare and submit monthly invoices and quarterly reports to CALFED (or Contracting Agency)		
TASK 1. LANDOWNER OUTREACH, EDUCATION, AND PROJECT PLANNING			
Subtask 1.1 Establishment of rangeland stewardship group	<ul style="list-style-type: none">• Survey landowner interest in participating in program (coordinate with initial landowner survey under Subtask 3.7)• Develop watershed rangeland improvement priority list and research agenda	<ul style="list-style-type: none">• Refine watershed rangeland improvement priority list and research agenda	<ul style="list-style-type: none">• Refine watershed rangeland improvement priority list and research agenda
Subtask 1.2 Whole ranch conservation plans and individual project planning	<ul style="list-style-type: none">• Develop comprehensive rangeland conservation plan with one or two large landowners (ongoing through subsequent years)• Develop implementation and management plans with individual landowners for conservation projects (under Task 2)	<ul style="list-style-type: none">▪ Continue to develop implementation and management plans with individual landowners for conservation projects (under Task 2)	<ul style="list-style-type: none">• Continue to develop implementation and management plans with individual landowners for conservation projects (under Task 2)
Subtask 1.3. Resource development and capacity building	<ul style="list-style-type: none">• Coordinate with program partners to provide technical and cost-share support• Conduct assessment of potential revolving loan fund• Identify conservation easement possibilities with willing landowners• Develop long-term funding plan for watershed	<ul style="list-style-type: none">• Continue to coordinate with program partners to provide technical and cost-share support▪ Continue to conduct assessment of potential revolving loan fund.• Continue to identify conservation easement possibilities• Continue to develop long-term funding plan for watershed	<ul style="list-style-type: none">• Continue to coordinate with program partners to provide technical and cost-share support• Continue to conduct assessment of potential revolving loan fund• Continue to identify conservation easement possibilities• Continue to develop long-term funding plan for watershed

Table 4. Continued

Subtask 1.4. Grass bank feasibility study	<ul style="list-style-type: none"> • Conduct literature search • Hold interviews with TNC/Malpais border group/ranchers • Define scope for potential Yolo County grass bank • Develop initial cost assessment 	<ul style="list-style-type: none"> • Field trip to Malpais Borderlands Group site • Complete draft feasibility study detailing acreage, membership rules • Circulate study among landowners/agency partners for comment 	<ul style="list-style-type: none"> • Complete feasibility study • Make recommendations on next steps • Initiate next steps if feasible
Subtask 1.5 Landowner training workshops	<ul style="list-style-type: none"> • Conduct 2 landowner training workshops ▪ Provide training in decision-support tool based on remote sensing data (under subtask 3.2) 	<ul style="list-style-type: none"> • Conduct 2 two training workshops • Provide additional training to landowners in decision-support tool based on remote sensing data (under subtask 3.2) • Share preliminary research results 	<ul style="list-style-type: none"> • Conduct 2 two training workshops. • Provide additional training to landowners in decision-support tool based on remote sensing data (under subtask 3.2) • Share preliminary and final research results
TASK 2. IMPLEMENTATION OF CONSERVATION AND RESTORATION ACTIVITIES			
Subtask 2.1 Riparian fencing and revegetation	<ul style="list-style-type: none"> • Fence approximately 1 mile of riparian corridor and revegetate a portion with native trees, shrubs, grasses • Coordinate management of project sites, including prescribed grazing, with landowners 	<ul style="list-style-type: none"> • Fence approximately 1 mile of riparian corridor and revegetate a portion with native trees, shrubs, grasses. • Coordinate management of project sites, including prescribed grazing, with landowners 	<ul style="list-style-type: none"> • Fence approximately 1 mile of riparian corridor • Coordinate management of project sites, including prescribed grazing, with landowners
Subtask 2.2 Prescribed burning	<ul style="list-style-type: none"> • Conduct 300-400 acres of prescribed burns. • Coordinate management of project sites, including prescribed grazing, with landowners 	<ul style="list-style-type: none"> • Conduct 300-400 acres of prescribed burns ▪ Coordinate management of project sites, including prescribed grazing, with landowners 	<ul style="list-style-type: none"> • Conduct 300-400 acres of prescribed burns • Coordinate management of project sites, including prescribed grazing, with landowners
Subtask 2.3 Native perennial grassland restoration	<ul style="list-style-type: none"> • Reseed 100 acres with native perennial grasses • Coordinate management of project sites, including prescribed grazing, with landowners 	<ul style="list-style-type: none"> • Reseed 100 acres with native perennial grasses • Coordinate management of project sites, including prescribed grazing, with landowners 	<ul style="list-style-type: none"> • Coordinate management of project sites, including prescribed grazing, with landowners
Subtask 2.4 Stock pond enhancement for wildlife and water quality	<ul style="list-style-type: none"> • Implement 1 stock pond enhancement project • Coordinate management of project sites, including prescribed grazing, with landowners 	<ul style="list-style-type: none"> • Implement 2 stock pond enhancement projects • Coordinate management of project sites, including prescribed grazing with landowners 	<ul style="list-style-type: none"> • Implement 1 stock pond enhancement project • Coordinate management of project sites, including prescribed grazing with landowners
Subtask 2.5 Control of gully erosion with bioengineering	<ul style="list-style-type: none"> • Conduct erosion control demonstration projects 	<ul style="list-style-type: none"> • Conduct erosion control demonstration projects 	<ul style="list-style-type: none"> • Conduct erosion control demonstration projects

Table 4. Continued

Task 3 Research, Assessment and Monitoring			
Subtask 3.1 Ground-based monitoring of vegetation response to conservation and restoration activities	<ul style="list-style-type: none"> • Draft/get approval of QAPP • Photo monitoring of all conservation activities under Task 2 • Photo plot monitoring of native perennial grassland restoration (subtask 2.2) • Step-point monitoring of prescribed burning and native perennial grassland restoration (subtasks 2.1 and 2.2) • grassland restoration (subtasks 2.1 and 2.2) • Census and assessment of woody shrubs/trees for riparian and stockpond enhancement sites (subtask 2.3 and 2.5) • Macroplot sampling for native grass density for restoration sites (subtask 2.2) • Erosion pin monitoring (subtask 2.5) • Submit annual progress report of findings 	<ul style="list-style-type: none"> • Photo monitoring of all conservation activities under Task 2 • Photo plot monitoring of native perennial grassland restoration (subtask 2.2) • Step-point monitoring of prescribed burning and native perennial grassland restoration (subtasks 2.1 and 2.2) • Census and assessment of woody shrubs/trees for riparian and stockpond enhancement sites (subtask 2.3 and 2.5) • Macroplot sampling for native grass density for restoration sites (subtask 2.2) • Erosion pin monitoring (subtask 2.5) • Submit annual progress report of findings 	<ul style="list-style-type: none"> • Photo monitoring of all conservation activities under Task 2 • Photo plot monitoring of native perennial grassland restoration (subtask 2.2) • Step-point monitoring of prescribed burning and native perennial grassland restoration (subtasks 2.1 and 2.2) • Census and assessment of woody shrubs/trees for riparian and stockpond enhancement sites (subtask 2.3 and 2.5) • Macroplot sampling for native grass density for restoration sites (subtask 2.2) • Photo monitoring of all Task 2 activities • Erosion pin monitoring (subtask 2.5) • Submit annual progress report of findings
			<ul style="list-style-type: none"> • Photo monitoring of all conservation activities under Task 2 • Photo plot monitoring of native perennial grassland restoration (subtask 2.2) • Step-point monitoring of prescribed burning and native perennial grassland restoration (subtasks 2.1 and 2.2) • Census and assessment of woody shrubs/trees for riparian and stockpond enhancement sites (subtask 2.3 and 2.5) • Macroplot sampling for native grass density for restoration sites (subtask 2.2) • Erosion pin monitoring (subtask 2.5) • Submit annual progress report of findings

Table 4. Continued

<p>Subtask 3.2 Rangeland monitoring and analyses using GIS and remote sensing technology (MSU subcontract-Qi and Malmstrom)</p>	<ul style="list-style-type: none"> ■ Identify cooperating landowners (land managers) to participate in GIS and remote sensing project (coordinate with conservation project sites under Task 2) ○ Develop watershed GIS system using digital elevation model, IKONOS panchromatic imagery (1 m2), and existing information about soils, land use, and fire patterns ■ Process monthly Landsat Thematic Mapper scenes ■ Monitor precipitation events and their timing relative to acquisition of all images ■ Measure aboveground biomass (green & senescent) and fractional cover ○ Begin calibration of biomass algorithms for watershed ○ Obtain spectral measurements of grassland cover (beginning, middle, and end of growing season) ■ Begin testing algorithms for species distribution mapping ■ Meet with participating property owners and managers, and adapt web-based delivery system to their needs ■ Submit annual progress report of findings 	<ul style="list-style-type: none"> ■ Continue to process monthly Landsat Thematic Mapper scenes. ■ Produce monthly maps of green and senescent vegetation for entire watershed rangelands ■ Continue to collect biomass samples, as in Year 1, for algorithm refinement ■ Make maps available to property managers and other users on a near-real-time basis with web-based system, and on paper if desired ■ Produce analyses of response of biomass to different management regimes in watershed test areas and for pastures, as requested by land managers ■ Acquire second set of images for species distribution mapping in test area ■ Obtain additional ground-based hyperspectral measurements of vegetation types in test plot, as needed for algorithm refinement and testing ■ Develop of species mapping algorithms. ■ Meet with participating users for user evaluation of data products and delivery system so far. ■ Submit annual progress report of findings 	<ul style="list-style-type: none"> ■ Continue Year 2 activities, (first 5 items.) ■ Acquire IKONOS multiband images for test area, and surrounding watershed. ■ Produce analysis of change in species distribution in test in response to management practices over last two years. ■ Produce map of grassland vegetation types for (upper) watershed rangelands, to be used for further conservation planning. (Is this the weed mapping part?-yes) ■ Meet with participating users for user evaluation of products, and discuss future development. ■ Finalize transfer of GIS layers and submit final progress report of findings
<p>Subtask 3.3 Determinants of successful upland rangeland restoration (UCD Subcontract-Young)</p>	<ul style="list-style-type: none"> ■ Conduct literature search ■ Establish initial forb experiments ■ Conduct monitoring of reseeded sites ■ Participate in landowner training workshops to disseminate research findings. Field days/workshops ■ Submit annual progress report of findings 	<ul style="list-style-type: none"> ■ Continue literature search ■ Establish additional forb treatments ■ Continue monitoring reseeded sites ■ Participate in landowner training workshops to disseminate research findings ■ Submit annual progress report of findings 	<ul style="list-style-type: none"> ■ Continue literature search ■ Establish final treatments ■ Continue monitoring ■ Participate in landowner training workshops to disseminate research findings ■ Submit final report of findings

Table 4. Continued

Subtask 3.4 Field and laboratory evaluation of palatability, selectivity and forage quality of native and introduced grasses and forbs (UCD Subcontract – Laca)	<ul style="list-style-type: none"> • Establish forage quality working group • Conduct field observations on selectivity • Conduct fecal analysis ▪ Analyze lab samples for nutritional status ▪ Participate in landowner training workshops to disseminate preliminary research findings 	<ul style="list-style-type: none"> • Distribute initial results to working group • Conduct field observations on selectivity • Conduct fecal analysis • Analyze lab samples for nutritional status • Submit final report of findings. 	
Subtask 3.5 Wildlife monitoring and assessment in restored perennial grassland and upland riparian sites (UCD Subcontract – Anderson)	<ul style="list-style-type: none"> • Establish study sites • Measure structural characteristics of vegetation • Conduct weekly point-count surveys • Submit annual report on findings 	<ul style="list-style-type: none"> • Measure structural characteristics of vegetation • Conduct weekly point-count surveys • Submit annual report on findings 	<ul style="list-style-type: none"> • Measure structural characteristics of vegetation • Conduct weekly point-count surveys • Submit final report on findings
Subtask 3.6 Field-based research on soil and plant response to restored perennial grasslands versus non-native annual grasslands (ARS Subcontract – Young and Steiner)	<ul style="list-style-type: none"> • Establish study sites and instrumentation • Monitor nitrogen and carbon cycling in soil approximately 9 times per year • Generate soil water retention curves and soil bulk density • Monitor soil compaction at least four times • Sample below- and above-ground plant biomass when the major grass species are at peak flowering • Collect water samples from suction cup lysimeters at least nine times per year • Submit annual progress report on findings 	<ul style="list-style-type: none"> • Monitor nitrogen and carbon cycling in soil approximately 9 time per year • Monitor soil compaction at least four times • Sample below- and above-ground plant biomass when the major grass species are at peak flowering. ▪ Collect water samples from suction cup lysimeters at least nine times per year ▪ Submit annual progress report on findings 	<ul style="list-style-type: none"> • Monitor nitrogen and carbon cycling in soil approximately 9 time per year • Generate soil water retention curves and soil bulk density • Monitor soil compaction at least four times. • Sample below- and above-ground plant biomass when the major grass species are at peak flowering • Collect water samples from suction cup lysimeters at least nine times per year. • Submit final report on findings
Subtask 3.7. Assessment of landowner participation in watershed stewardship	<ul style="list-style-type: none"> • Conduct baseline surveys 		<ul style="list-style-type: none"> • Conduct follow-up surveys • Produce final report on findings

<p>Subtask 3.8 Cost assessments of conservation and restoration activities</p>	<ul style="list-style-type: none"> Record cost data on Task 2 implementation activities Produce initial per acre/per site implementation cost reports by project and by subtask 	<ul style="list-style-type: none"> Continue with year one activities Add year two management costs Investigate cost-saving measures and alternative implementation options Produce second year per acre/per site implementation and management cost reports 	<ul style="list-style-type: none"> Continue with year one and year two activities Produce final cost assessment for each activity Produce final report with recommendations on cost saving measures Provide results to Yolo RCD for update <i>Bring Farm Edges Back to Life</i> book (RCD 2000) and incorporate into other landowner outreach tools
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easements, grassbanking, and others as identified by the landowners. Implementation and monitoring will be coordinated with Task 2 and Task 3 activities below, including forage and habitat assessment using remote sensing and a web-based decision support tool developed with remote sensing data (Subtask 3.2).

Subtask 1.3 Resource development and capacity building. Project staff will: 1) develop a long-term funding plan and identification of institutional support for the watershed program (e.g. funding through state budget categories, an expanded RCD program, etc.); 2) conduct a feasibility study on a revolving loan fund to provide bridge loans for landowners needing capital while they await reimbursement from cost share agencies; 3) work with the California Rangeland Trust, Yolo Land Trust, and other organizations to evaluate and identify conservation easement options; and 4) work with NRCS to develop and implement existing pilot projects for using burning and grazing to improve habitat on CRP lands.

Subtask 1.4 Grass bank feasibility study. Seasonal grass banking is a support program successfully implemented within managed landscapes around the country (R. Reiner, pers. com.). A model program has been developed by the Malpai Borderlands Group (MPG) in Arizona and New Mexico (Cheater 1995, Glenn 2000, Page 1997). Grass banking provides dedicated acres of reserved forage, which members may access while resting or restoring portions of their working range. This provides effective mitigation for the short-term loss of production following prescribed burning or other restoration activities. Project staff will conduct a strategy assessment of grass banking and identify of key constraints and opportunities for the watershed. Following completion of the strategy assessment, the 3rd-year activities will focus on developing recommended steps to establish and test a local grass bank.

Subtask 1.5. Landowner training workshops. Project staff will conduct two training workshops for landowners each year on rangeland conservation and restoration topics. Landowner trainings and other forums will serve as an opportunity to disseminate findings from research and monitoring project under Task 3. Staff will also work closely with Michigan State University faculty to coordinate landowner involvement with remote sensing project and web-based decision support tool (Subtask 3.2).

Task 2. Implementation of conservation and restoration activities

Subtask 2.1 Riparian fencing and revegetation. Grazing by livestock has damaged 80% of the streams and riparian ecosystems in arid regions of the western U.S. (USDI 1994), by affecting watershed hydrology, stream channel morphology, soils, vegetation, riparian-dependent wildlife species, and water quality at both local and regional scales (Belsky et al. 1999). Fencing and revegetating riparian areas can reverse these trends by controlling livestock distribution and grazing intensity and improving wildlife habitat (USDI 1997). In this subtask, we are proposing to triple our current rangeland riparian program, by working with ranchers to fence 3 miles of riparian habitat. Approximately 1 mile (75-100 acres, depending on width of fenced area) will be selected for revegetation with native grasses, trees, and shrubs. Project activities include coordinating with landowners to design fencing plans, site preparation, planting, installation of temporary irrigation, weed control, development of long term management plans that include prescribed grazing, and monitoring.

Subtask 2.2 Prescribed burning to control noxious weeds and brush. Prescribed burning is increasingly being used successfully in California's rangelands to increase native species richness (Barrows et al. 1998, The Nature Conservancy 1999) and control medusahead, yellow star thistle, and to a lesser extent, goat grass (Barrows et al. 1998; DiTomaso et al. 1999, Hatch et al. 1999, Hopkinson et al. 1999, Menke 1980, Wirka 1999). Preliminary monitoring of 300 acres burned in 1999 under the USSWIP shows improved forage, good control of medusahead and high survival of native perennial grasses. Therefore, we propose

to expand the fire program to an additional 1200 to 1500 acres between years 2001 and 2004. Doing so requires that we augment our in-house fire program with leadership training and additional equipment. Projects include site evaluation, developing burn prescriptions, soliciting participation of CDF, The Nature Conservancy, and local VFDs, planning and executing prescribed burns. Audubon's legislative staff will work with CDF to increase state-funded capacity for prescribed fire.

Subtask 2.3 Native perennial grassland restoration. Native perennial grasses help to stabilize the soil, improve rainwater infiltration, provide wildlife habitat, and a longer forage season for livestock (Anderson 1999). They are becoming increasingly accepted by mainstream range managers (C. Cesmat, pers. com., Wood 2000). Preliminary monitoring of the 180 acres we reseeded in 1999 under the USSWIP shows high germination of native grass seedlings, but higher-than-expected competition from weeds and thus higher management costs. As techniques evolve to promote successful establishment (see Subtask 3.3), other major barriers remain, including ranchers' biases against natives as forage and the high per acre cost of native grass seed. We are proposing to continue our grassland restoration efforts on an additional 200 acres coupled with intensive research and monitoring efforts. Projects will include site preparation, range drilling, and post-seeding management. We will work closely with the landowners to develop long term management plans for reseeded pastures that include prescribed grazing.

Subtask 2.4 Stockpond habitat enhancement. The Willow Slough Plan identifies stock pond habitat enhancement with associated development of off-pond watering systems as an important, relatively simple rangeland improvement. UCCE and NRCS have developed stock water systems that use solar powered pumps to deliver water from a pond to watering troughs, allowing livestock access to water without trampling riparian and aquatic habitat. Through our experience developing a successful proposal to fund 2 stock pond projects at the Yolo Land and Cattle Company (Stone Ranch) in 1999, we learned that this practice is not only very popular among area landowners, it is very attractive to cost-share agencies as well. Therefore, we are proposing to develop and implement an additional 4 stock pond enhancement projects. Projects include site preparation, installation of fencing, troughs and solar pumps; revegetation with native grasses, sedges, rushes, trees, and shrubs; weed control; and long term management plans that includes prescribed grazing.

Subtask 2.5 Control of gully erosion through bioengineering. Gully erosion continues to be a serious problem in upper watershed, thought to be triggered by geomorphic processes resulting from large-scale alterations in the landscape (pers. com. M. Cock and V. Finney, NRCS State Office). Small scale and relatively inexpensive methods to control gully erosion using animal impact methods (G. Work, pers. com.), straw bales, willows, and geotextiles promise to be compatible with ranching and habitat enhancements. Through this subtask, Audubon will continue efforts initiated in 1999 under the USSWIP to develop small-scale erosion control demonstration projects with 3 to 4 landowners using bioengineering. We will coordinate with NRCS to develop priorities and strategies. We will also explore gully erosion preventive measures, such as road design and maintenance techniques, and grazing management.

Task 3. Research, assessment and monitoring

Subtask 3.1 Ground-based monitoring of vegetation response to conservation and restoration activities. Audubon staff will monitor all Task 2 subtasks using methods approved by EPA in our current Quality Assurance Project Plan (Wirka 2000) developed under the USSWIP. These include photo monitoring at seasonal intervals for all subtasks; photo plot monitoring of reseeded areas (Subtask 2.3), step-point monitoring of rangeland species composition before and after burn and seeding treatments (Subtasks 2.2

and 2.3), census and assessment of woody shrubs and trees in riparian and stock pond enhancement areas (Subtask 2.1, 2.4 and 2.5), macroplot sampling of native grass density following burn treatments (Subtask 2.2), and erosion pin monitoring (Subtask 2.5). Program staff will also conduct biomass surveys five to seven times a year in conjunction with Subtask 3.2 (below).

Subtask 3.2 Rangeland monitoring and analyses using GIS and remote sensing technology. Successful long-term and large scale conservation and restoration efforts in the watershed will require that spatial and temporal information about habitat and forage quality as well as species distributions be available at a watershed scale. Audubon-California will work with Michigan State University's Basic Science Remote Sensing Initiative (BSRSI) in *this* subtask. The BSRSI is not only a leader in using advanced spatial technologies, but has successfully employed them in a NASA-funded Arizona project to develop a prototype tool that individual ranchers are now using to make sound land management decisions (Qi et al. 2000). Activities in this subtask include: 1) developing a GIS platform on which to base watershed-scale ecological monitoring using a Digital Elevation Model, **IKONOS** panchromatic imagery, and existing GIS information; 2) monitoring the spatial and temporal distribution of biomass variables (standing biomass levels and fractional cover) with monthly satellite images calibrated with on-the-ground measurements; 3) providing information on the spatial distribution of rangeland species, including native perennial grasses and nonnative invasive species using spectral measurements of cover types, 4) delivering a decision support tool in a web-based format with privacy protections to assist landowners and project personnel in conservation and restoration planning; and 5) providing analyses of response of biomass variables to different management regimes to allow project personnel and landowners to test hypotheses related to prescribed burning, controlled grazing, and reseeding of native perennial grasses (see Subtasks 2.1-2.3 and Table 3). BSRSI personnel will also work with Audubon staff to train landowners in the use and evaluation of the web-based decision tool (see Subtask 1.5).

Subtask 3.3 Determinants of successful upland rangeland restoration. In spite of increasing momentum, practical restoration techniques in California grasslands have gone largely untested (Young 2000). At the same time, the pernicious presence of nonnative invasive range species threatens to dampen further progress (Brown and Rice 2000, J. Anderson, pers. com). Audubon will subcontract with Dr. Truman Young of U.C. Davis' Department of Environmental Horticulture to conduct a two-part research project on watershed rangelands that have or will undergo burning and/or reseeding treatments. Research questions to be addressed include: 1) What ~~are~~ are the correlates of success in establishing perennial grasses and controlling nonnative invasive species across soil types, topographies, and species mixes? and 2) What are the native forb species appropriate for rangeland restoration and how are they best established. The approach includes controlled studies of fertilizer and herbicide treatments, broad vegetation surveys stratified by soil type, topography, species mix, and treatments, and controlled replicated experiments varying herbicide treatments and timing of forb plantings.

Subtask 3.4 Field and laboratory evaluation of palatability, selectivity and forage quality of native and introduced perennial grasses. Palatability of native grass is thought to be quite high (C. Cesmat, NRCS., pers. com.) and initial data suggest forage quality of native grasses in the watershed may be equal to or greater than traditional forage species (Wrysinski et al. 1998). However, a lack of credible scientific data based on local studies is one of the major barriers native grassland restoration in the watershed. Through this subtask, Audubon will subcontract with Dr. Emilio Laca of U.C. Davis' Department of Agronomy and Range Science to conduct a two year study on palatability, selectivity, and forage quality of native grasses. The approach will compare natural and restored stands of natives with nonnative annual forage grasses. It includes field observation of foraging preference (selectivity) along with fecal analysis to provide a "stand-in" measure of palatability, along with laboratory analysis of forage quality of grass

samples collected from natural and reseeded areas. Audubon project staff will also work with the subcontractors to coordinate a native grassland forage working group to share information among forage quality experts from U.C.C.E, NRCS, TAMU, and local landowners.

Subtask 3.5 Wildlife monitoring and assessment in restored perennial grassland and upland riparian sites. Habitat restoration can best be judged by increased use of restored sites by wildlife over time. Yet, little data exists on wildlife use of restored grassland and riparian habitats. Audubon will add an important wildlife monitoring component to this project, using upland birds as indicator species, through a subcontract with Dr. Dan Anderson of U.C. Davis' Department of Wildlife, Fish and Conservation Biology. The subcontractor will conduct a 3-year avian monitoring project in several of our sites to monitor the trends of the avian community in response to upland perennial grassland and riparian restoration, and to determine how does avian species richness, density and community structure change as the systems approach reference (goal) conditions. The project will also determine how the installation of supplemental structures, such as brush piles and perches, influence avian abundance and species diversity.

Subtask 3.6 Field-based research on soil and plant response to restored perennial grasslands versus non-native annual grasslands. There is little information about how native perennial grasses under California rangeland and climate conditions affect biotic and abiotic factors compared to non-native annual grass systems. Audubon will subcontract with the USDA Agricultural Research Service (ARS) to conduct a three year field-based study to determine the impact of establishing native perennial grasses on soil quality and nutrient cycling, soil water percolation and retention, soil compaction, and response of the soil weed seed bank. This work will build on studies already undertaken by ARS in the watershed and will be coordinated with additional studies proposed by the ARS and Yolo RCD. The approach will be based on comparisons among four research sites that differ in restoration stage to test hypotheses that determine the nature, magnitude, and direction of the soil and plant responses to perennial grassland restoration compared to annual grassland systems.

Subtask 3.7 Assessment of participation in landowner stewardship. Little information is available on the effectiveness of different approaches to engaging landowners in stewardship activities. Through this subtask, we will systematically evaluate the outreach components under Task 1 to test the hypotheses related to Tenet 1 of our conceptual model. We will conduct an initial survey of landowners to assess their perceptions of issues and constraints as well as their relative comfort with outreach and assistance approaches, including meetings, one-on-one technical assistance, cost-share programs, "bridge" loans, conservation easement programs, a "grass-banking" program, training workshops and web-based decision-support tools. In the third year of the program we will conduct a follow-up survey to assess changes in landowners perceptions regarding these activities. Initial and final surveys will take the form of questionnaires mailed to each watershed landowner, as well as follow-up personal interviews with as many landowners as possible.

Subtask 3.8. Cost assessments of conservation and restoration activities. Based on our experience with the USSWIP, we believe that exploring means to reduce costs will remove a major barrier for more widespread adoption of conservation practices. The Yolo RCD has produced general cost analysis for implementation of various farmland practices (Yolo RCD, 1999). However, information on rangeland practices is lacking. We will use cost data recorded during our current USSWIP, and record additional data on Task 2 implementation activities to compile a per unit (e.g. acre, site) cost analysis of each of the rangeland conservation practices under the program, including implementation and maintenance. We will also explore alternatives for reducing costs for each of the practices. Our findings will be disseminated at landowner trainings (see Subtask 1.5) and shared with the Yolo RCD for incorporation into their outreach

materials.

Task 4. Program Management

Program Management includes all aspects of program oversight, such as inspection of work progress, fulfillment of contract reporting requirements, and invoicing associated with each task. Program management includes general program expenditures associated with the program (excluding service contracts), such as staff salaries, general program equipment, and mileage associated with each task described below.

c. Monitoring and Assessment Plans

Monitoring and assessment plans for evaluating proposed conservation and restoration activities and to test the series of hypotheses presented in Tables 2 and 3 are contained in Task 3 of the scope of work. Individual workplans for research subcontracts contained in Appendix 2 describe monitoring and assessment plans for these subtasks in greater detail.

d. Data Handling and Storage

Project participants will report on their progress to the project manager on a regular basis. Principal investigators responsible for research subcontracts will be responsible for synthesizing interpretive summaries of their data and providing these summaries to program manager. According to the guidelines established by CALFED, the principal investigators will submit 2 annual and one final report to the project manager. The project manager will then be responsible for synthesizing all information into one integrated report for submission to CALFED. Individual workplans for research subcontracts contained in Appendix 2 describe the data handling and storage procedures for this component of the program.

e. Expected Products/Outcomes

See Table 4 and research subcontract work plans in Appendix 2.

f. Work Schedule

See Table 4 for the annual work schedule. Each subtask under Task 1 and 2 could potentially be separately funded. Treatments for research and monitoring subtasks under Task 4 are dependent on implementation of additional projects under Task 2, and could only be separately funded if some corresponding implementation project was also funded. Subtasks under each of the 3 tasks are in order of our priorities for receiving funding.

g. Feasibility

Based on our experience in the USSWIP, we are confident that the proposed projects are feasible. Because of the strong relationships we have built with ranchers and the interest they have expressed in participating in this next-phase of the program, we are confident that they will provide access to their properties for conservation and restoration projects. Individual research workplans contained in Appendix 2 address the feasibility of these components of program.

D. Applicability to CALFED ERP Goals and Implementation Plan and CWIA Priorities

1. ERP Goals and CVPIA Priorities

The Willow Slough Watershed Rangeland Stewardship Program supports the “habitat vision” for agricultural lands presented in the ERPP (VI, p. 169) by encouraging agricultural management practices that improve wildlife habitat values to support special-status wildlife populations and other wildlife

dependent on the Bay-Delta. It also supports the major focus of the Yolo Basin Ecological Management Zone expressed in the ERPP (VII. pp. 341-353) by increasing the health of its important ecological processes, habitats, and fish, wildlife species, and plant populations and makes substantial contributions to the health of the Delta. The program embraces the concept presented in the ERPP (W. p. 342) that "a change in land stewardship practices can correct the negative impacts while maintaining, and in some cases, improving the agricultural economic base." It also applies to the vision for the Willow Slough Ecological Management Unit by "integrating agriculture and natural habitats in a manner to support ecological health." The ERPP (VII. p. 345) states that the health of the Ecological Management Units of the Yolo Basin Ecological Management Zone "can be maintained and restored only with the active participation of local watershed groups, which include local landowners and concerned individuals".

The Willow Slough Watershed Rangeland Stewardship Program is applicable to these ERPP Goals:

Goal 1. At-Risk Species: The grassland, riparian and oak woodland habitats in the project area provide important habitat for at-risk species. The activities to be implemented with private ranchers are intended to increase forage diversity and availability throughout the year and improving habitat values for the following grassland and riparian wildlife species. Protection and enhancement of riparian habitats, and restoration of native perennial grassland habitats is expected to benefit the neotropical bird guild (Group IV) (VI. p. 364), by increasing quality breeding and migratory habitats. Restoration of native perennial grassland is expected to improve forage diversity, and plantings of large overstory riparian trees species is also expected to provide nesting sites for California Swainson's hawks and other raptors (Group III) (VI. p. 252). Fencing and revegetation of riparian corridors and habitat enhancement of stockwater ponds will include planting of Mexican elderberry (*Sambucus mexicana*), the host plant of the Valley Elderberry Longhorn Beetle (Group III) (VI. p. 288). Fencing stockponds and restoring associated aquatic, wetland, riparian, surrounding grassland habitats is expected to benefit the California tiger salamander (Group III) (VI. pp. 324) and the Western spadefoot toad (Group III) (VI. p. 327) by enhancing breeding and estivating areas. Restoration of aquatic, wetland, and riparian habitats associated with stock ponds is also expected to potentially benefit the California red-legged frog (Group III) (VI. p. 330) by providing breeding habitat, forage and escape cover for this species. Enhancement of riparian, wetland, aquatic, and surrounding grassland habitats associated with streams and stock ponds may benefit the Western pond turtle (Group III) (VI. p. 336) by providing increasing forage habitat, cover, nest and hibernation sites.

Goal 3. Harvestable Species: In a manner consistent with Goal 1, the proposed restoration and conservation activities are intended to maintain and enhance populations of Central Valley upland game species (Group IV) (ERPP VI. p. 367), and migratory waterfowl (Group IV) (ERPP VI. p. 360) by improving habitat values for these species. Riparian enhancement and restoration of native perennial grasslands are expected to improve forage diversity and availability, and nesting habitat for migratory waterfowl (Group IV) (VI. p. 360). Enhancement of waterfowl habitat is of high interest to recreational hunters in the area, and provides strong incentives for participation of private landowners in conservation and restoration activities. The ring-necked pheasant, wild turkey, dove, cottontail rabbit, which are also popular game for hunting in the region, would benefit from activities under the program.

Goal 4. Habitats: The proposed program will restore functional habitat types, especially riparian (ERPP VI. p. 143 and VII. p. 344) and perennial grassland habitats (ERPP VI. pp. 25, 26, 102, 164) on rangelands for public values. The proposed program will also establish incentive programs to encourage landowners to establish and maintain perennial grasslands on their properties (ERPP VI. p. 166); and implement an intensive management program to control non-native vegetation (ERPP VI. p. 167). Consistent with this goal, the program will improve rangeland management (ERPP VII. p. 335), reducing livestock grazing in

riparian zones (ERPP VI. p. 149), and improving associated wildlife habitat values on agricultural land to support special-status and other wildlife (ERPP VI. p. 169).

Goal 5. Non-native Invasive Species: Proposed restoration and conservation activities are designed to reduce the negative biological and economic impacts of non-native invasive species. We intend to demonstrate that range management techniques, including prescribed burning and livestock grazing can be used as large-scale restoration tools to control populations of non-native invasive range species and support habitat enhancements.

Goal 6. Sediment and Water Quality: The proposed activities are intended to improve water quality and reduce sediment flowing to waterways within the upper Willow Slough watershed and ultimately into the Bay-Delta system. Riparian fencing and revegetation of riparian corridors is expected to reduce nutrient and sediment loading by minimizing trampling of stream banks and defecation into streams by livestock. Sediment loading into upper watershed waterways will also be reduced through targeted experiments with biotechnical materials to control gully and streambank erosion.

2. Relationship to Other Ecosystem Restoration Projects;

3. Requests for Next-Phase Funding; and

4. Previous Recipients of CALFED or CVPIA funding

The proposed Willow Slough Rangeland Stewardship Program is the next phase of the currently-funded Union School Slough Watershed Improvement Program (CALFED grant # 98-E13). The focus of the next-phase will be to build on the lessons we have learned through the Union School Slough program, and initiate systematic assessment and monitoring efforts to evaluate the contribution of restoration and conservation activities to ERPP goals within the Willow Slough Watershed Ecological Management Unit (ERPP, VII. pp. 341-353).). The current status of the program and the progress and accomplishments of the program to date are described in Appendix 1.

5. System-Wide Ecosystem Benefits

The Willow Slough Plan recognizes that the upper and lower watershed resource problems are intimately tied to one another, so that only an integrated approach to managing watershed resources in the watershed can improve overall watershed health. The Yolo RCD and Audubon are submitting separate, but mutually supportive proposals for next-phase funding of the Union School Slough Watershed Improvement Program. Yolo **RCD** has developed a workplan for tasks on Union School Slough's lower watershed, while Audubon's proposal address rangeland management throughout the WSP plan area. Together these proposals provide a synergistic, and integrated approach to implementing the Willow Slough Plan.

E. Qualifications

Audubon program staff will be responsible for program oversight, and carrying out most of the work under Tasks 1 and 2 of the scope of work. Their qualification are described below. General qualification for the Principal Investigators responsible for carrying out research workplans under Task 3 of the scope of work are contained in Table 5. More detailed descriptions of their qualification are contained in the workplans contained in Appendix 2.

Daniel Taylor, Audubon-California. **Mr.** Taylor is the Executive Director of Audubon-California, and will continue to provide oversight of the program. **Mr.** Taylor has served on the Audubon staff for over 20 years. He has a master's degree in biology with an emphasis in plant ecology. He has served as chair of the Central Valley Habitat Joint Venture and of the California Riparian Habitat Joint Venture. He also

Table 5. Summary of Qualification of Principal Investigators for Research Subcontracts under Task 3

Principal Investigator	Current Position	Research project under Task 3	Educational Experience	Key expertise
Dr. Carolyn Malmstrom	Assistant Professor, Dept. of Botany and Plant Pathology & Dept. of Geography, Basic Science & Remote Sensing Initiative, Michigan State University, East Lansing, Michigan	Rangeland monitoring and analyses using GIS and remote sensing technology (Subtask 3.2)	A.B. Biology, Harvard College, 1987; Ph.D. Department of Biological Sciences, Stanford University, 1997	Grasslands and forest ecologist who works with ecosystem dynamics at a variety of scales across landscapes. More than ten years of experience applying remote sensing technology in vegetation dynamics research, making significant contributions to the development of production algorithms. Current research focuses on California grasslands and rangelands, where she is funded for several projects investigating the response of grassland dynamics to changes in disturbance regimes.
Dr. Jiaguo Qi	Assistant Professor, Dept. of Geography, Basic Science & Remote Sensing Initiative, Michigan State University, East Lansing, Michigan	Rangeland monitoring and analyses using GIS and remote sensing technology (Subtask 3.2)	B.S., Physics, Harbin Teacher's Normal University, Harbin, China, 1981; M.S. in Soil, Water and Environmental Sciences, University of Arizona, 1989; Ph.D. Soil, Water and Environmental Sciences, University of Arizona 1993	Research interests focus on theoretical development and applications of remote sensing technologies to study the dynamics of the earth surface and its environmental impacts at variable spatial and temporal scales. Develops vegetation indices, canopy radiative transfer models, data fusion, and assimilation techniques to quantitatively derive surface physical and biophysical properties. Works on new sensor technology and develops approaches to using new data types for global change and resources management.
Dr. Truman Young	Assistant Professor Restoration Ecology, Department of Environmental Horticulture, University of California at Davis	Determinants of successful upland rangeland restoration (Subtask 3.3)	B.A., University of Chicago; Ph.D., University of Pennsylvania	Research interests spanning a broad range of plant population and community ecology. Current research emphasizes human dominated landscapes, rangeland management and habitat restoration.
Dr. Emilio Laca	Professor of Range Sciences, Department of Agronomy and Range Science, University of California at Davis	Field and laboratory evaluation of palatability, selectivity and forage quality of native and introduced perennial grasses (Subtask 3.4)	Ph.D. Range Science, University of California at Davis, 1992	An agricultural ecologist, with research interest on range management, foraging behavior models on different spatial scales, ungulate impact on plant communities. Extensive work in central Asia on the application of geostatistics in site specific agricultural practices to minimize impact and optimize production.

Table 5. Continued

Dr. Dan Anderson	Department of Wildlife, Fish and Conservation Biology, University of California Davis'	Wildlife monitoring and assessment in restored perennial grassland and upland riparian sites (Subtask 3.5)	B.S. Zoology, North Dakota State University; M.S. and PhD in Wildlife Ecology and Zoology, University of Wisconsin, 1971	Current research involving studies of contamination effects, distribution, and dynamics of organic and inorganic materials in birds from California and Baja California coastal and wetland environments. Actively involved in the conservation and management of avian populations and their habitats.
Dr. Stephen Griffith	Research Plant Physiologist, USDA-Agricultural Research Service, Corvallis, OR	Field-based research on soil and plant response to restored perennial grasslands versus non-native annual grasslands (Subtask 3.6)	B.S. Education/Botany from Utah State University, Logan, UT 1980; M.S. Plant Science, Utah State University, 1983; Ph.D., Plant Physiology, University of Minnesota, 1986	Current team member and leader of groups of scientists addressing sustainable grass seed cropping systems with emphasis on small farm sustainability. Specific research involves the soil biogeochemistry of agricultural and unmanaged lands as it relates to N and C cycling, especially under hydric conditions, riparian zone function in improving water quality, and applying site specific process and biogeochemical information in a landscape context.
Dr. Jeffrey J. Steiner	Research Agronomist, USDA-Agricultural Research Service, Corvallis, OR	Field-based research on soil and plant response to restored perennial grasslands versus non-native annual grasslands (Subtask 3.6)	B.S. & M.S. Agronomy, California State University, Fresno; Ph.D. Seed Production and Technology, Oregon State University, 1982.	Specific research involves assessment of economic and environmental impacts of alternative conservation practices in rangeland systems and to define soil quality effects of different practices based on soil arthropod composition and weed seed bank changes.

has served on several state commissions including the California Timberlands Task Force (as established by SB 1580) and the Upper Sacramento River Fisheries and Riparian Habitat Advisory Council (as established by SB 1086).

Judy Boshoven, Audubon-California. Ms. Boshoven will continue to serve as the watershed coordinator and program manager for the program. She has a B.A. degree in Landscape Architecture from UC Davis, and a master's degree in Environmental Planning and Policy from MIT. She is a licensed Landscape Architect. Before becoming the Watershed Coordinator for Union School Slough Watershed Improvement Program, Ms. Boshoven was a Project Manager for four years Jones & Stokes Associates, a leading environmental consulting firm in Sacramento. Her work focussed primarily on planning and design of riparian and wetland restoration projects. As the watershed coordinate for the Union School Slough Watershed Improvement Program, Ms. Boshoven's primary responsibilities have been project management and administration, ensuring regulatory and permitting requirements are met for project implementation, and coordination with landowner and agency participants.

Jeanne Wirka, Restoration Ecologist, Audubon-California. Ms. Wirka will continue to serve as the Restoration Ecologist for the program. Ms. Wirka has an undergraduate degree from Harvard University and a master's degree in Ecology from UC Davis, with an emphasis on plant community ecology. She has four years of experience in riparian and grassland restoration using native California species. As the restoration ecologist for the past year on the Union School Slough Watershed Improvement Program, Ms Wirka primary responsibilities have been developing detailed project implementation plans and designs, developing monitoring and assessment protocols, and coordinating the implementation and monitoring of restoration projects with individual landowners.

Range Management Specialist, Audubon-California. A qualified range management specialist will be hired prior to project initiation to assist with project design and implementation with watershed landowners.

F. Cost

1. Budget

A program budget is included in Table 6, which details costs for each year of the 3 year program, and total costs for the overall program. The budget also identifies all budgeted costs requested for each task listed in the scope of work under Section C.2.b of the proposal.

Salaries and benefits: Salaries and benefits for program staff are included in the budget under the Program Management task (excluding those included in service contracts). Salaries include 3 full-time program staff: 1) a watershed coordinator with an average annual salary of \$52,000; 2) a restoration ecologist with an average annual salary of \$49,920; and 3) a range management specialist with an average annual salary of \$45,760. Benefits are included as 35% of salaries. Most of the salaries and benefits for the watershed coordinator and restoration ecologist are provided for through April 2002 by the currently-funded phase of the program. As we expect that the next phase of the program will be initiated in April of 2001, only partial salaries for these two positions for the overlapping year (2001/2002) have been included in the budget.

Travel: Travel expenses are included in the budget under the Program Management task (excluding those included in service contracts). Audubon bought a truck for the current phase of the program, which is

udget

		Subject to Overhead						Exer
	Direct Labor Hours	Salaries	Benefits	Travel	supplies & Expendables	Service Contracts	Overhead (10%)	Equipm
Education, and project planning								
ngeland stewardship group					\$1,500		\$150	
ation plans and individual project planning					\$1,500		\$150	
nt and capacity building					\$1,500		\$150	
/ study					\$1,000		\$100	
workshops					\$3,500	\$1,000	\$450	
		\$0	\$0	\$0	\$9,000	\$1,000	\$1,000	
ervation and restoration activities								
revegetation					\$24,695	\$3 1,566	\$5,626	
					\$3,511	\$6,750	\$1,026	
land restoration					\$45,354	\$7,650	\$5,300	
lent for wildlife and water quality					\$13,720	\$6,000	\$1,972	
ion with bioengineering					\$4,484	\$5,600	\$1,008	
		\$0	\$0	\$0	\$91,764	\$57,566	\$14,933	
d monitoring								
oring of vegetation response to conservation and restoration activities					\$500		\$50	
g and analyses using GIS and remote sensing technology (MSU subcontract								
						\$127,100	\$12,710	
essful upland rangeland restoration (UCD Subcontract – Young)						\$22,718	\$2,272	\$:
valuation of palatability, selectivity and forage quality of native and								
orbs (UCD Subcontract – Laca)						\$28,778	\$2,878	
and assessment in restored perennial grassland and upland riparian sites								
lerson)						\$22,676	\$2,268	
on soil and plant response to restored perennial grasslands versus non-								
(ARS Subcontract – Griffith and Steiner)						\$34,747	\$3,475	
wner participation in watershed stewardship					\$2,000		\$200	
conservation and restoration activities							\$0	
		\$0	\$0	\$0	\$2,500	\$236,019	\$23,852	\$:
	2,080	\$4,160	\$1,456				\$562	
	2,080	\$6,240	\$2,184				\$842	
	2,080	\$45,760	\$16,016				\$6,178	
				\$4,000			\$400	\$:
lent	6,240	\$56,160	\$19,656	\$4,000	\$0	\$0	\$7,9821	\$:
	6,240	\$56,1601	\$19,656	\$4,0001	\$103,2641	\$294,585	\$47,767	\$:

	Direct Labor Hours	Salaries	Benefits	Travel	Subject to Overhead Supplies & Expendables	Service Contracts	Overhead (10%)	Exer Equipm
Education, and project planning								
angeland stewardship group							\$0	
ation plans and individual project planning							\$0	
nt and capacity building							\$0	
y/ study				\$2,400	\$2,000			
workshops					\$2,000	\$1,000	\$300	
		\$0	\$0	\$2,400	\$4,000	\$1,000	\$300	
ervation and restoration activities								
revegetation					\$24,695	\$31,566	\$5,626	
					\$1,762	\$5,750	\$751	
ssland restoration					\$44,794	\$8,250	\$5,304	
ment for wildlife and water quality					\$27,440	\$12,000	\$3,944	
ion with bioengineering					\$4,484	\$5,600	\$1,008	
		\$0	\$0	\$0	\$103,175	\$63,166	\$16,634	
d monitoring								
oring of vegetation response to conservation and restoration activities					\$500		\$50	
g and analyses using GIS and remote sensing technology (MSU subcontract								
uccessful upland rangeland restoration (UCD Subcontract – Young)						\$89,061	\$8,906	
evaluation of palatability, selectivity and forage quality of native and						\$22,718	\$2,272	
orbs (UCD Subcontract – Laca)						\$28,778	\$2,878	
and assessment in restored perennial grassland and upland riparian sites								
erson)						\$21,442	\$2,144	
on soil and plant response to restored perennial grasslands versus non-								
(ARS Subcontract – Griffith and Steiner)						\$35,555	\$3,556	
wner participation in watershed stewardship					\$2,000		\$200	
conservation and restoration activities							\$0	
		\$0	\$0	\$0	\$2,500	\$197,554	\$20,005	
k 1				\$4,000			\$400	
						\$12,440	\$1,244	
	2,080	\$52,000	\$18,200				\$7,020	
	2,080	\$49,920	\$17,472				\$6,739	
	2,080	\$45,760	\$16,016				\$6,178	
ment	6,240	\$147,680	\$51,688	\$4,000	\$0	\$12,440	\$21,581	
	6,240	\$147,680	\$51,688	\$6,400	\$109,675	\$274,160	\$58,520	

	Direct Labor Hours	Subject to Overhead Salaries Benefits Travel supplies & Expendables Service Contracts Overhead (10%)						Exempt Equipment
Education, and project planning								
Watershed stewardship group							\$0	
Management plans and individual project planning							\$0	
Outreach and capacity building							\$0	
Field study					\$2,000		\$200	
Workshops					\$2,000	\$1,000	\$300	
		\$0	\$0	\$0	\$4,000	\$1,000	\$500	
Conservation and restoration activities								
Revegetation					\$24,335	\$31,166	\$5,550	
					\$1,662	\$4,850	\$651	
Upland restoration					\$6,434	\$5,000	\$1,143	
Permit for wildlife and water quality					\$13,720	\$6,000	\$1,972	
Work with bioengineering					\$4,484	\$5,600	\$1,008	
		\$0	\$0	\$0	\$50,635	\$52,616	\$10,325	
Field monitoring								
Monitoring of vegetation response to conservation and restoration activities					\$500		\$50	
Mapping and analyses using GIS and remote sensing technology (MSU subcontract)						\$129,842	\$12,984	
Successful upland rangeland restoration (UCD Subcontract – Young)						\$23,663	\$2,366	
Field evaluation of palatability, selectivity and forage quality of native and introduced forbs (UCD Subcontract – Laca)								
Monitoring and assessment in restored perennial grassland and upland riparian sites (MSU subcontract – Peterson)						\$21,442	\$2,144	
Monitoring on soil and plant response to restored perennial grasslands versus non-restored (ARS Subcontract – Griffith and Steiner)						\$36,397	\$3,640	
Farmer participation in watershed stewardship					\$2,000		\$200	
Monitoring conservation and restoration activities							\$0	
		\$0	\$0	\$0	\$2,500	\$211,344	\$21,384	
				\$4,000			\$400	
						\$12,440	\$1,244	
	2,080	\$52,000	\$18,200				\$7,020	
	2,080	\$49,920	\$17,472				\$6,739	
	2,080	\$45,760	\$16,016				\$6,178	
Total	6,240	\$147,680	\$51,688	\$4,000	\$0	\$12,440	\$21,581	
	6,240	\$147,680	\$51,688	\$4,000	\$57,135	\$277,400	\$53,790	
		\$351,520	\$123,032	\$14,400	\$270,074	\$846,145	\$160,071	\$0

Equipment associated with research subcontracts will be included in the service contract.

primarily used in the field for implementing and monitoring restoration and conservation projects. Travel expenses for the second phase of the program include diesel fuel for the truck, and additional mileage for use of personal vehicles for program purposes.

Supplies: Supplies (items that cost less than \$1000 or more per unit and have an expected life of less than 3 years) are included in the budget under each subtask (excluding those included in service contracts). The types of supplies required for the program generally include field materials for implementing and managing conservation and restoration projects, expendable office materials, photocopies, postage, and photographic film and processing.

Service contracts: As mentioned previously, Audubon will be the contracting party responsible for payments, reporting, and accounting for the program. Audubon will subcontract components of monitoring and assessment (Task 3) of the program to the University of California Davis, Michigan State University, and USDA Agricultural Research Service as described in the scope of work under Section C.2.b. These subcontracts are identified as service contracts in the program budget. Individual budgets for these service contracts are contained in research workplans in Appendix 2.

Subcontractors that we expect to perform portions of the work to implement restoration and conservation projects under Task 2 of the scope of work have not yet been identified. Cost estimates for these service contracts are based on our experience with this work under the current phase of the program.

Equipment: Most equipment required has been purchased as part of our current phase of the program. Only costs associated with maintenance of this equipment during the last two years of the program will be charged to the next phase of the program. These costs are reflected as a service contract under Project Management for each task. Additional equipment to be purchased for the next-phase of the program including two lap top computers and an ATV trailer, are reflected as equipment purchase under Project Management for Task 1 in the first year.

Overhead: An overhead rate of 10% is included on the total program budget (excluding equipment and graduate student fee remissions). Overhead includes costs associated with general office requirements such as rent, phones, furniture, general office staff, and internal agency costs associated with management of the program funds, including subcontracts. Overhead costs are not different for state and federal funds.

2. Cost-Sharing.

Within the first year, Audubon has been extremely successful in obtaining cost-share contributions for the USSWIP. Table 7 summarizes cost-share contributors and the estimate value of their contributions to date. The table also provides an estimated value of future contributions to the Willow Slough Watershed Rangeland Stewardship program as a next phase of our efforts.

G. Local Involvement

The program area lies within the unincorporated area of Yolo County. The county has been supportive of the Union School Slough Watershed Improvement Program, and has been notified of this proposal for next-phase funding (see Section J and Appendix 6). We have received letters of support from local agricultural organizations and agencies including the Yolo County Farm Bureau, and the Woodland Field Office of the NRCS. Various landowners have written letters of interest in participating in the proposed program. Letters of support and interest are contained in Appendix 3.

Table 7. Primary cost-share contributions

Cost-share contributors	Types of contributions	Estimated value of contributions to date	Estimated value of future contributions	Total estimated contributions
CALFED Bay-Delta Program (Grant #98-E13)	<ul style="list-style-type: none"> • Technical assistance • Project implementation • Equipment and supplies 	\$230,000*	\$406,000*	\$636,000*
NRCS	<ul style="list-style-type: none"> • Technical assistance • Project implementation cost-share (EQIP) • In-kind project implementation services 	\$50,000	\$75,000**	\$125,000
Yolo RCD	<ul style="list-style-type: none"> • Technical assistance • In-kind project implementation services 	\$5,000	\$20,000	\$25,000
DFG	<ul style="list-style-type: none"> • Technical assistance • Project implementation cost-share funds from Wildlife Conservation Board 	\$40,000		\$40,000
USFWS	<ul style="list-style-type: none"> • Technical assistance • Project implementation cost-share funds from Partners for Fish and Wildlife 	\$25,000	\$40,000***	\$65,000
ARS	<ul style="list-style-type: none"> • Technical assistance • Use of equipment and supplies 	\$200,000	\$450,000	\$650,000
CDF	<ul style="list-style-type: none"> • Technical assistance • Equipment donations 	\$5,000	\$20,000	\$25,000
USCOE	<ul style="list-style-type: none"> • Technical assistance • Materials donation 	\$5,000		\$5,000
UCCE	<ul style="list-style-type: none"> • Technical assistance 	\$2,000	\$6,000	\$8,000
Watershed Landowners	<ul style="list-style-type: none"> • Technical assistance • In-kind project implementation services 	\$10,000	\$50,000	\$60,000
NFWF	<ul style="list-style-type: none"> • Project implementation cost-share funds 	\$16,000	\$100,000****	\$116,000
Packard Foundation	<ul style="list-style-type: none"> • Project implementation cost-share 	\$16,000		\$16,000
Michigan State University	<ul style="list-style-type: none"> • Technical assistance • Use of equipment 		\$30,000	\$30,000
UC Davis	<ul style="list-style-type: none"> • Technical assistance • Use of equipment and supplies 	\$2,000	\$50,000	\$52,000

*Union School Slough Watershed Improvement Program (current phase of program).

**EQIP cost-share applications from Union School slough Watershed landowners pending approval.

***Yolo RCD has a \$20,000/year renewable cooperative agreement with Partners for Fish and Wildlife to implement conservation and restoration projects with private watershed landowners.

****NFWF cost-share funds to Yolo RCD for Union School Slough Watershed program pending approval.

H. Compliance with Standard Terms and Conditions

Audubon will comply with the state and federal standard terms contained in Attachments D and E of the Proposal Solicitation Package. The following completed forms are included in Appendix 4 to comply with standard terms and conditions:

- Letter from Audubon's Attorney at Law regarding requirements for contractor's license for construction activities
- Nondiscrimination Compliance (Audubon and subcontractors)
- Non Collusion Affidavit
- Federal Form 424

I. Literature Cited

Literature cited in the proposal is contained in Appendix 5. Additional literature specific to research and monitoring approaches and methods is contained within the workplans for each research subcontractor in Appendix 2.

J. Threshold Requirements

The following materials are included in Appendix 6 to fulfill the threshold requirements of the proposal:

- Letters of Notification to Yolo County
- Environmental Compliance Checklist
- Land Use Checklist

Appendices

Appendix 1. Union School Slough Watershed Improvement Program

Appendix 2. Work Plans for Research Subcontracts under Task 3

Appendix 3. Letters of Support and Interest

Appendix 4. Compliance with Standard Terms and Conditions

- A. Letter from Audubon's legal council regarding requirements for contractor's license and bidder's bond]
- B. Nondiscrimination Compliance (from Audubon and subcontractors)]
- C. Non Collusion Affidavit
- D. Federal Form **424**

Appendix 5. Literature Cited

Appendix 6. Threshold Requirements

- A. Letters of Notification to Yolo County
- B. Environmental Compliance Checklist
- C. Land Use Checklist

Appendix 1.

Union School Slough Watershed Improvement Program

Union School Slough Watershed Improvement Program

Audubon-California and the Yolo RCD launched the Union School Slough Watershed Improvement Program (USSWIP) (CalFed contract #98-E13) in April 1999. The project has successfully completed more than a year's worth of activities and has expended approximately \$230,000 of its \$636,000 budget. We are working on 9 active restoration and conservation projects with 6 landowners and are in the planning stages for projects with 4 additional landowners.

The USSWIP staff provides direct technical and financial assistance to individual landowners in the Union School Slough watershed to implement the conservation and restoration activities described below. Equally important, however, has been the role project personnel have played in building momentum for farm and rangeland restoration in the watershed. Indeed, demand for our services has been so high, we have added staff hours to the program and continue to seek additional financial support and technical support from participating agencies whenever possible. The following is a summary of accomplishments to date in each of the main program areas:

Upper watershed riparian restoration: Together with the joint owners of a 1200-acre cattle ranch, we developed and began installation of a 1-mile riparian fencing and restoration project. In the Fall of 1999, we erected a fence to exclude cattle in the short term and provide for future grazing management within the approximately 50-acre riparian pasture. We also planted and installed irrigation on three pilot riparian sites to determine riparian species survival prior to larger scale riparian plantings next fall. In addition, we developed erosion control pilot projects with NRCS engineers using biotechnical materials on several gullies and streambanks within the riparian zone. During the next two years, we will continue to monitor and assess restoration success. Additional funding will allow us to continue and expand these monitoring efforts and to develop an appropriate grazing management program for the project area.

Upper watershed rangeland restoration: Between May 27 and June 17, 1999, we conducted prescribed burns on approximately 300 acres of rangelands that were heavily invaded by medusahead, goatgrass and yellow star-thistle. The burn program has been working in cooperation with the landowners and the California Department of Forestry (CDF) provided training and in-kind services as well as a significant donation of Nomex burn suits. We also held a two day prescribed fire workshop in October 1999. Our goal under the currently funded program is to burn an additional 700 acres within the next two years. The success of this activity for managing rangeland weeds and improving forage quality has resulted in a high level of interest among watershed ranch managers and landowners.

We worked with a sheep rancher and cattle rancher to reseed two rangeland project sites (170 acres and 10 acres, respectively) that had been burned last spring. Seeding occurred in November 1999, with follow-up management and monitoring ongoing. A National Fish and Wildlife Foundation grant has allowed us to increase our original goal of seeding 200 acres in three years by 40 acres. As proposed under Task 3 of the current proposal, sites seeded last fall now provide a unique opportunity to monitor and assess our restoration techniques and benefits of native perennial grassland systems.

Construction of tailwater ponds: During our first year of the program, we constructed one tailwater pond and vegetated it with native perennial grasses, trees, and shrubs. The pond is based on a design developed by the Natural Resources Conservation Service and the Yolo RCD. This simple double-pond tailwater system can be easily managed with a back-hoe and does not require permits. It traps sediment from row crop irrigation tailwater and provides wildlife habitat. Interest in the ponds is high and we expect to install 4 additional ponds over the next two years with the funding available. The Yolo RCD is proposing utilize these pond sites as part of its monitoring and assessment program proposed under the 2001 CALFED solicitation process.

Revegetation of irrigation canals and drainage ditches: The Yolo RCD has developed a method for establishing native vegetation, including native grasses, sedges, and rushes, on canal and ditch banks to reduce erosion and long-term maintenance requirements. We have worked with a participating landowner and the Yolo County Flood Control and Water Conservation District to establish plantings on an approximately 1000-foot section of the Winters Canal. Activities have included reshaping and preparing soils along banks, establishing native vegetation, and controlling weeds. The Yolo RCD is proposing to utilize this project site as part of their monitoring and assessment program proposed under the 2001 CALFED solicitation process.

Lower watershed riparian enhancement: Working with NRCS, we planned and designed a major riparian habitat project with a cooperating landowner on an approximately 1/2-mile section of Union School Slough in the lower watershed area. The project involves removing of exotic vegetation, excavating a 30-foot-wide floodplain bench along one side of the slough, and revegetating the bench and slough banks with native riparian species. Project approvals by regulatory agencies are almost complete. The arrival of a pair of California Swainson's hawks delayed the removal of exotic vegetation this spring but, depending on their nesting status, implementation of the project should begin in June. The Yolo RCD is proposing to utilize this project site as part of their monitoring and assessment program proposed under the 2001 CALFED solicitation process.

Landowner outreach, training and technical support: The project team has been very successful at providing coordination and communication among landowners in the watershed, and organizations and agencies that have been able to provide assistance. The cooperative relationships we have developed with watershed landowners provide the basis for the proposed expanded project. In our first year we held four training workshops for landowners. Workshop topics included: prescribed burning (co-sponsored by The Nature Conservancy and California Native Grass Association--CNGA), restoration using native grasses (co-sponsored by CNGA), construction of tailwater ponds (co-sponsored by the Yolo RCD) and riparian enhancement on sloughs (co-sponsored by the Yolo RCD). No additional funding for workshops is available through the current program, but we will continue to coordinate with the Yolo RCD, NRCS, TNC, and CNGA to plan additional workshops.

Cost-share funding: One of the most important roles program staff played during the past year was to link watershed landowners with sources of cost-share funding for projects above and beyond those funded through our CalFed grant. Simply informing landowners of cost-share opportunities and with NRCS and providing project planning assistance, for example, increased local applications to its Environmental Quality Incentives Program. We secured additional grants from the National Fish and Wildlife Foundation and the Department of Fish and Game's Wildlife Conservation Board, respectively to expand our work on rangeland and riparian enhancement activities. We also secured a \$20,000 renewable cooperative agreement with the USFWS's Partners for Fish and Wildlife Program. We are in the process of applying for various other grants and securing cost-share funding on behalf of landowners.

Monitoring and assessment: The U.S. Environmental Protection Agency has approved the Quality Assurance Program Plan (QAPP) for the program. Monitoring to date has included photo monitoring of all project sites, step-point monitoring of vegetation before and after burn and seeding treatments, qualitative monitoring of woody plant survival, and erosion pin monitoring on rangeland. We have also collected water quality samples in cooperation with the USDA Agricultural Research Service, in a related project on water quality. However, more extensive monitoring has not been possible due to a lack of funding and time. Therefore, our proposal for next phase funding relies more heavily on research subcontracts to produce data of high enough quality to be used in our proposed adaptive management process.



< In Fall of 1999, a 50-acre riparian corridor on upper watershed ranch was fenced to control livestock access to this area.

In Fall and Winter of 1999/2000, several areas were planted with cottonwoods and willows within the floodplain of the fenced riparian corridor.





^

In Winter of 2000, **NRCS** Woodland Field Office conservationist assisted with installation of jute fiber mat and native perennial grass **plugs** to experiment with biotechnical erosion control methods on streambanks within the fenced riparian cooridor.

(In Winter of 2000, we installed Enka mat **and** native perennial grass plugs to experiment with biotechnical erosion control methods on a newly forming gully within the fenced riparian corridor.



In Spring of 1999, we conducted approximately 300 acres of prescribed burns in the upper watershed to control medusa head, a noxious non-native weed.



Prescribed burns were conducted with the assistance of the California Department of Forestry and Fire Protection, cooperating landowners, and volunteers.

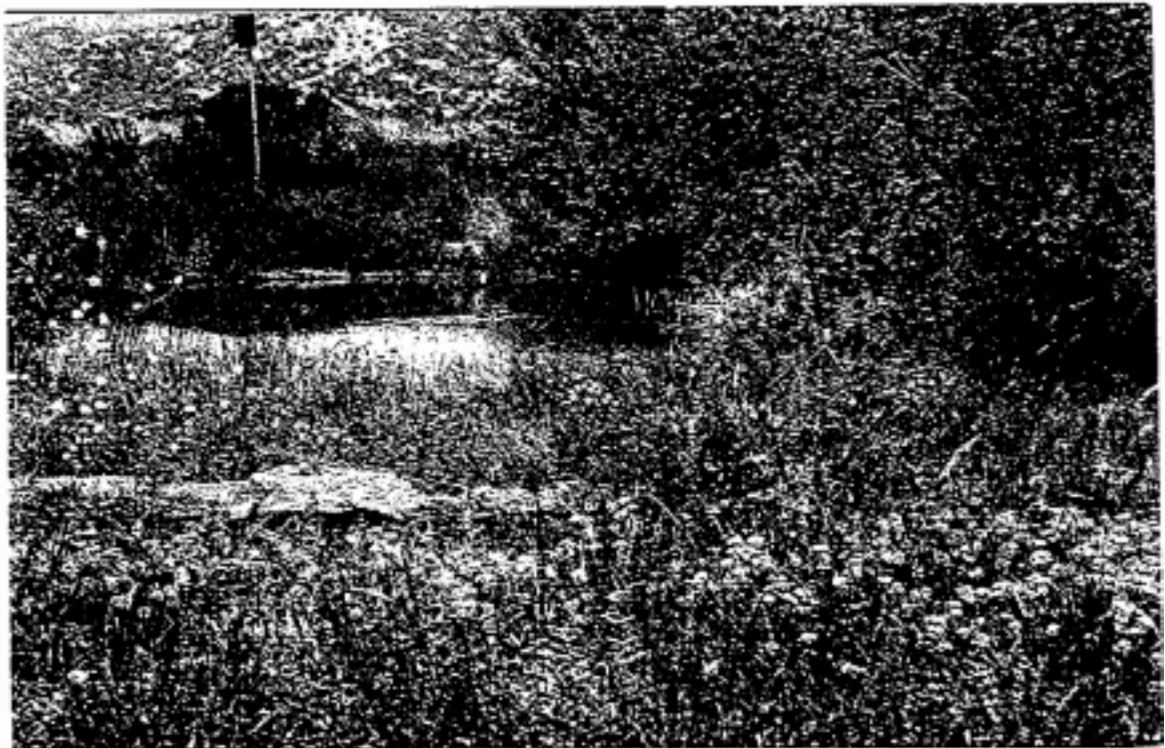


After burning, **native perennial grasses** were seeded on approximately 200 acres of **rangeland**.

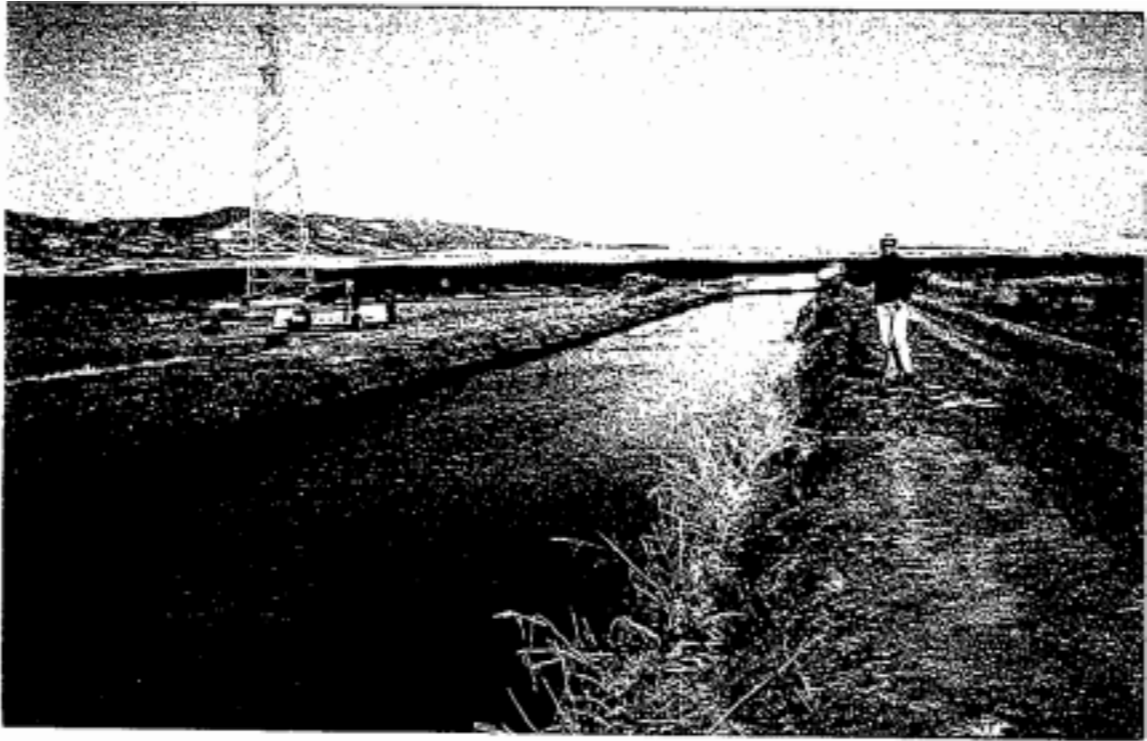


In Summer of 1998, we excavated a tailwater pond on a lower watershed pond to capture sediment from irrigation runoff.

In Fall of 1998, the pond was planted with native grasses, shrubs, and trees, that will eventually provide quality habitat for wildlife.



This established tailwater pond, built about 8 years ago in the watershed; provides a successful model for our tailwater pond projects.



Irrigation canal before planting with native perennial grasses.



In **Fall** of 1999, the **banks** of a 1000-foot section of irrigation canal were planted with native perennial grasses. **Jeanne** Wirka, the program's restoration ecologist, is harrowing in the seed:



These established native plantings along a watershed irrigation canal provide a successful model for our irrigation canal projects.



Judy Boshoven, the program's watershed coordinator, meets with an NRCS State Office engineer, the landowner, and the local flood control district, to discuss plans for the riparian restoration project on Union School Slough in the lower watershed.



Vic Claassen, U.C. Davis soil scientist, assesses soil conditions before establishment of native perennial grassland restoration project. There has been a high level of interest in conducting research on Union School Slough restoration project sites.



A grassland restoration workshop, co-sponsored with the California Native Grass Association, was **one** of four **training** sessions held during the **first** year of the program

Appendix 2.

Work Plans for Research Subcontracts under Task 3

PROPOSED RESEARCH SUBCONTRACT WITH AUDUBON-CALIFORNIA
CALFED Bay-Delta Program **2001** Proposal Solicitation (May **15,2000**)

Rangeland monitoring and analyses **using GIS** and remote sensing technology in the Willow Slough Watershed (Subtask **3.2**)

Co-Principal Investigators: Dr. Carolyn Malmstrom, Dr. Jiaguo Qi
Department of Geography
Basic Science Remote Sensing Initiative
Michigan State University
East Lansing, MI

Successful long-term and large scale conservation and restoration efforts in the Willow Slough Watershed will require that spatial and temporal information about habitat and forage quality as well as species distributions be available at a watershed scale. Michigan State University's Basic Science Remote Sensing Initiative proposes to work with Audubon-California to establish a remote sensing program to provide data on above ground biomass and species distributions in the watershed that will allow project staff, landowners, and other watershed stewards to monitor and evaluate important parameters. BSRSI will also develop a web-based decision support tool that uses this data. BSRSI is not only a leader in using advanced spatial technologies, but has successfully employed them in a NASA-funded Arizona project to develop a prototype tool that individual ranchers are now using to make sound land management decisions (Figure 1, attached) (Qi et al. 2000).

Workplan

The purpose of this project is to 1) develop a GIS platform on which to base large-scale ecological monitoring efforts in the Willow Slough Watershed using a Digital Elevation Model, IKONOS panchromatic imagery, and existing GIS information; 2) monitor the spatial and temporal distribution of biomass variables with monthly satellite images calibrated with on-the-ground measurements; 3) provide information on the spatial distribution of rangeland species, including native perennial grasses and nonnative invasive species using spectral measurements of cover types; 4) deliver a decision support tool in a web-based format with privacy protections to assist landowners and project personnel in conservation **and** restoration planning; and 5) provide analyses of response of biomass to different management regimes to allow Audubon personnel and landowners to test hypotheses related to prescribed burning, controlled grazing, and reseedling of native perennial grasses.

Approach

1. GIS Framework.

The first step in establishing a large-scale ecological monitoring system for the watershed is to develop a basic GIS platform on which to build later analyses. We would use the advanced GIS capabilities at MSU's Basic Science and Remote Sensing Initiative (see cost-sharing) to develop a GIS system for the 10-mile² watershed, using ARC/INFO and ARCView software for easy transfer of GIS layers and data to other users. For the foundation for the GIS system, we will combine a high-resolution digital elevation map (DEM) with a high-resolution panchromatic image that will allow us to identify and interpret critical landscape features and provide an anchor for additional layers. For the DEM, we will obtain an SRTM version with 6-cm resolution that will be valuable for hydrologic analyses. For the panchromatic image, we will obtain IKONOS panchromatic scenes at 1 m² spatial resolution for the entire watershed. On to this base, we will add layers that incorporate existing information about soils, vegetation, and hydrologic features; land ownership maps; records of past and present stocking levels; fire maps; and information about other relevant ecological events

2. Monitoring and analyzing biomass dynamics.

Some of the most useful data for both conservation planners and range managers is information about the spatial and temporal distribution of biomass, including mean biomass levels and fractional cover (the relative portion of soil covered by biomass). For conservation planning in grasslands, standing biomass levels and fractional cover are often used as indicators of wildlife habitat quality and soil-erosion protection. For planning prescribed burns, standing biomass levels give a good indication of how well fires may carry. For range managers, standing biomass represents both forage and RDM and is thus a central factor in decision-making.

Remote sensing techniques allow us to regularly assess grassland biomass values over large areas. Assessments can be made on a monthly basis or more frequently depending upon which satellite-borne sensors are used. A common approach for assessing vegetation properties with remote sensing has been to employ the Normalized Difference Vegetation Index (NDVI), a vegetation index defined as the difference in infrared and red radiances divided by their sum (Sellers et al., 1992). NDVI is a measure of the relative radiances from vegetated and non-vegetated surfaces and thus gives a good indication of how much green plant material there is relative to exposed soil surface or other material within an area. NDVI has been calibrated with ground-based data to predict measures such as green leaf area index or standing green biomass at different sites.

It is important to note that NDVI predicts green leaf area or biomass better than senescent material, because the NDVI is based on the assumption that soils and actively growing vegetation absorb differently in the chlorophyll region. Senescent vegetation is not well described with NDVI. Until recently, this constraint has limited the usefulness of NDVI-base assessments of rangeland condition, because both standing green and standing senescent vegetation are important

rangeland resources. The new NDSVI index (Qi et al., 2000) allows us to overcome this problem and produce assessments of senescent grassland biomass as well.

For the rangeland monitoring proposed here, we would use NDVI and NDSVI on data from Landsat Thematic Mapper to produce monthly (or near-monthly, depending on cloud cover) maps of green and senescent grassland biomass for the watershed area. These maps would be at a 30-m² resolution. Satellite-based biomass estimates would be calibrated against field plots harvested simultaneously with image-capture and then used to predict grassland biomass variables throughout the watershed. Biomass maps would be available to property owners and managers on a near-real-time basis beginning in the second year of the project (see section on web interface below), typically within two weeks of image acquisition (the delivery of first-year images may be somewhat slower owing to the time required for system setup). Thus, an individual property owner would be able to follow the temporal dynamics of biomass accumulation and use throughout her/his property for the duration of this project. This information would allow the property owner to monitor her/his range conditions through a variety of weather patterns (given the typically high annual variability of California's precipitation patterns), determine how well range resources were being utilized throughout the property, and experiment with different management regimes. BRSI personnel will work with Audubon staff to train landowners in the use and evaluation of the web-based decision tool (see Subtask 1.5 in main proposal).

In addition to the biomass assessments, we will provide analyses of the response of biomass variables to different management regimes, using spatial analysis techniques and the GIS system. We will work with project personnel and landowners to test hypotheses related to prescribed burning, controlled grazing, and reseeded of native perennial grasses.

3. Monitoring species distribution.

The second type of information that is extremely useful for conservation planning and range management is information about the spatial distribution of species types throughout a property. New sources of multi-band data with fine spatial resolution are making it easier for remote sensing to provide this information. For this watershed area, we believe we can fairly straightforwardly distinguish several groups of grassland species, based on their distinct phenological and color characteristics. At a **minimum** we will map four categories of vegetation: 1) **annual** grassland species with good forage value; 2) cool-season native perennial species; 3) the noxious weed yellow star thistle; and 4) medusahead, another significant rangeland weed.

We will begin the mapping work by focusing on a single square-mile area containing the critical vegetation types. We will use three images (beginning of growing season, mid-growing season, end-of-growing season) of multi-spectral IKONOS data (4m² resolution) to develop signatures for these vegetation types, using ground-based data for calibration. To aid in this, we will also evaluate images from the hyperspectral EO-1 radiometer, which will be available for part of the first and second growing seasons. The signatures developed in the first year will be tested again

in the second year and used to evaluate the results of on-the-ground manipulations of cover types within the third year.

Data handling and storage

BSRSI is a leader in remote sensing information technology. BSRSI computers will be used to store data and provide web-based access to information for ranchers. Ground-based biomass and cover data will be handled by Audubon's range specialist and delivered to BSRSI personnel electronically. All data will be backed up in California and Michigan.

Expected products and outcomes

1. A GIS system for the watershed that would be available to all watershed managers and could be used to ask questions beyond those addressed in *this* initial work. 2. Web-based delivery of near real-time patterns of biomass values. 3. A grasslands vegetation classification based on spectral imagery for the entire 10mi² watershed. This product will serve as a comprehensive base line for conservation planning and evaluations of invasive species. The GIS layers and near-real-time biomass maps will be available to property owners both as traditional paper products and as digital products posted and archived on the BSRSI website. BSRSI staff will also participate in training meetings with landowners. 4) Multi-temporal analyses of the response of biomass variables to different management regimes, using spatial analysis techniques and the GIS system. These analyses will allow landowners and project personnel to test hypotheses related to prescribed burning, controlled grazing, and reseedling of native perennial grasses.

Work schedule

Work Schedule for MSU/BSRSI Subcontract

Year 1 (2001)

1. Develop watershed GIS system using digital elevation model, IKONOS panchromatic imagery (1 m²), and existing information about soils, land use, and fire patterns.
2. Process monthly Landsat Thematic Mapper scenes.
3. Monitor precipitation events and their timing relative to acquisition of all images (important to correct for wetness of vegetation/soils in image analysis).
4. Collect samples of aboveground biomass (green & senescent) from six geo-referenced 2m x 2m plots in each grassland cover type (see species work below), concurrent with 5 satellite image acquisition time points across year. Dry and weigh samples. Audubon personnel to assist with biomass collection and weighing.
5. Begin calibration of biomass algorithms for watershed.
6. Obtain spectral measurements of grassland cover types from georeferenced points in test area (1 mi²) with hyperspectral sensor at three time points (beginning, middle, and end of

growing season) coincident with IKONOS multiband image acquisition and EO-1 image acquisition.

7. Begin testing algorithms for species distribution mapping.
8. Meet with participating property owners and managers, and adapt web-based delivery system to their needs.

Year 2 (2002)

1. Continue to process monthly Landsat Thematic Mapper scenes.
2. Produce monthly maps of green and senescent vegetation for entire watershed, using NDVI and NDSVI algorithms calibrated with ground-based data.
3. Continue to collect biomass samples, as in Year 1, for algorithm refinement.
4. Make maps available to property managers and other users on a near-real-time basis with web-based system, and on paper if desired.
5. Produce analyses of response of biomass to different management regimes in watershed test areas and for pastures, as requested by land managers.
6. Acquire second set of images for species distribution mapping in test area from IKONOS multiband radiometer and EO-1 (3 time points during year, as before).
7. Obtain additional ground-based hyperspectral measurements of vegetation types in test plot, as needed for algorithm refinement and testing.
8. Development of species mapping algorithms.
9. Meet with participating users for user evaluation of data products and delivery system so far.

Year 3 (2003)

1. Continue Year 2 activities, numbers 1-5.
2. Acquire IKONOS multiband images for test area, and surrounding watershed.
3. Produce analysis of change in species distribution in test area in response to management practices over last two years.
4. Produce map of grassland vegetation types for watershed, to be used for further conservation planning.
5. Meet with participating users for user evaluation of products, and discuss future development.
6. Finalize transfer of GIS layers to Audubon California.

Feasibility

BSRSI has already demonstrated that this approach is feasible in Arizona and is already being used by land managers there (Qi et al 2000). Audubon staff have polled area ranchers who have expressed a keen interest in having access to this type of information. Cooperation with and support from Audubon-California project staff on the ground insures timely on-the-ground data collection. BSRSI's extensive resources for and experience in remote sensing and GIS ensure that

any challenges encountered with algorithm development and product delivery will be addressed quickly and appropriately.

Cost sharing by MSU/BSRSI

- Hyperspectral radiometer for obtaining characteristic radiance signatures for vegetation species. ~\$15K
- Global Positioning System ~\$10k
- Use of BSRSI computers for webserver for product access by landowners.
- Use of BSRSI software licenses for remote sensing and GIS work (ARCinfo, ERDAS etc.)
- Technology transfer of remote sensing indices and website interface, developed with funding outside CalFed.

Qualifications

Dr. Carolyn Malmstrom, Michigan State University. Dr. Malmstrom will be the co-Principal Investigator for rangeland monitoring and analyses using GIS and remote sensing technology (Subtask 3.2). Dr. Malmstrom received an A. B. Biology, magna cum laude, from Harvard College in 1987, and a Ph.D. from the Department of Biological Sciences from Stanford University, 1997. She has been an Assistant Professor at Michigan State University, Dept. of Botany and Plant Pathology & Dept. of Geography, Basic Science & Remote Sensing Initiative since August 1999. Dr. Malmstrom is a grasslands and forest ecologist who works with ecosystem dynamics at a variety of scales across landscapes. She has more than ten years of experience applying remote sensing technology in vegetation dynamics research and has made significant contributions to the development of production algorithms. Her current research focuses on California grasslands and rangelands, where she is funded for several projects investigating the response of grassland dynamics to changes in disturbance regimes. The Basic Science and Remote Sensing Initiative at Michigan State University is a leading remote sensing and spatial technology group focused on land-use and land-cover issues around the world, with a number of projects in Western grasslands.

Jiaguo Qi, Michigan State University. Dr. Qi will be the Co-principal Investigator for rangeland monitoring and analyses using GIS and remote sensing technology (Subtask 3.2). Dr. Qi received a B.S. in Physics, 1981, from Harbin Teacher's Normal University, Harbin, China, a M.S. in Soil, Water and Environmental Sciences, 1989, from the University of Arizona, and a Ph.D. in Soil, Water and Environmental Sciences, 1993, from University of Arizona. Since 1998, Dr. Qi has been an Assistant Professor at Michigan State University, East Lansing, Michigan. Dr. Qi's research interests focus on theoretical development and applications of remote sensing technologies to study the dynamics of the earth surface and its environmental impacts at variable spatial and temporal scales. He develops vegetation indices, canopy radiative transfer models, data fusion, and assimilation techniques to quantitatively derive surface physical and biophysical properties. He works on new sensor technology and develops approaches to using new data types for global change and resources management. He also works on theoretical development of

algorithms to detect crop stresses due to water and nitrogen deficiencies using fine spatial and spectral resolution imagery and ground-based remote sensing measurements.

References

Qi, J. Y. H. ~~Kerr~~, M. S. Moran, M. Weltz, A. R. Huete, S. Sorooshian, and R. Bryant. 2000 Leaf area index estimates using remotely sensed ~~data~~ and BRDF models in a semi arid region, *Remote Sensing of Environment*.

Sellers PJ, ~~JA~~ Berry, GJ Collatz, CB Field, & FG Hall. 1992. Canopy reflectance, photosynthesis, and transpiration, III. Reanalysis using improved leaf models and a new canopy integration scheme. *Remote Sensing of Environment* 42(3) 187-216.

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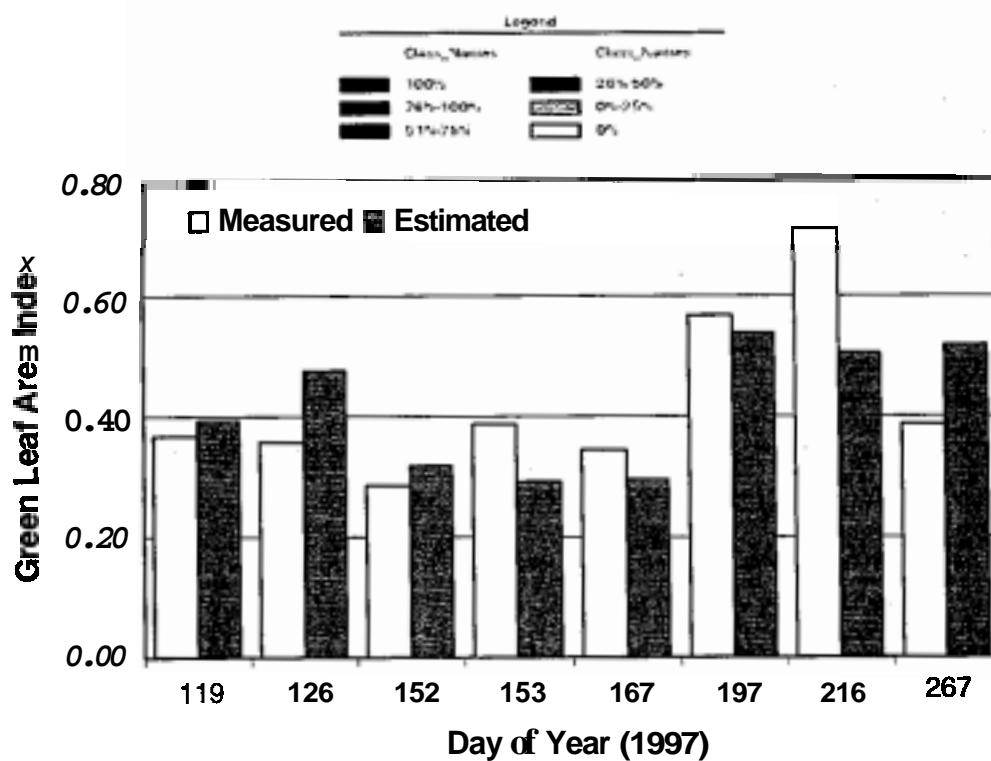


Figure 1. Fractional cover map and comparison with ground data

BUDGET:**PROJECT TITLE:**

CALFED Subcontract

PRINCIPAL INVESTIGATORS:CAROLYN MALMSTROM
JIAGUO QI**PROJECT PERIOD**Period 1: 1/1/01-12/31/01
Period 2: 1/1/02-12/31/02
Period 3: 1/1/03-12/31/03

	YEAR 1	YEAR 2	YEAR 3	TOTAL
PERSONNEL:				
C. Malmstrom (2 mo. summer sal)	11,405	11,862	12,336	35,603
J. Qi (2 mo. Summer sal)	11,405	11,862	12,338	35,603
Undergraduate hourly (GIS) 10 hrs per week, 32 weeks per academic yr	2,500	2,600	2,704	7,804
Undergraduate hourly, summer, 100%, 15 weeks per year	4,350	4,524	4,705	13,579
Fringe Benefits @ 7.5% summer sal	1,711	1,779	1,850	5,340
Total Personnel costs:	31,371	32,626	33,931	97,929
TRAVEL:				
Malmstrom	6,000	6,400	7,000	19,400
Qi	6,000	6,400	7,000	19,400
EQUIPMENT:				
Project computer	10,000		-	10,000
GPS	3,000			3,000
MATERIALS AND SERVICES:				
GIS system				
Digital Elevation Model: 6 cm SRTM	5,000			5,000
IKONOS pan. scene: 10 for ws	10,000			10,000
Biomass Evaluation				
Landsat TM images: 12 per year	7,800	7,800	7,800	23,400
Species Mapping				
IKONOS multiband: 3 scenes (yr 1, yr 2) for focus area	3,000	3,000	3,000	
EO-1: 3 scenes (yr 1, yr2) for focus area and surrounding region	1,950	1,950		3,900
IKONOS multiband 3 scenes (yr 3) for entire watershed (focus area already ac.)			27,000	27,000
Other				
Misc. project supplies	2,000	2,000	2,000	6,000
Met station	3,000			3,000
TOTAL DIRECT COSTS:	69,121	60,176	87,731	237,029
INDIRECT COSTS @ 48% MTDC*:	37,978	28,885	42,111	109,974
TOTAL BUDGET	107,099	89,061	129,842	346,003

MICHIGAN STATE UNIVERSITY

DEPARTMENT OF BOTANY AND PLANT PATHOLOGY

EAST LANSING • MICHIGAN • 48824-1312

FAX NUMBER (517) 353-1926

May 10, 2000

Ms. Judy Boshoven
Audubon-California
Yolo County RCD
221 West Court Street, Suite 1
Woodland CA 95696

Dear Ms. Boshoven,

We are pleased to submit this proposal for subcontract research with your proposed CalFed project. We are very excited about the project and the opportunity to work with Audubon-California on these important watershed issues.

Sincerely,



Carolyn M. Malmström, Assistant Professor & Principal Investigator



Fred Salas, Senior Contracts & Grant Administrator, Michigan State University

proposal No.:

principal Investigator: Carolyn Malmstrom & Jiaguo Qi

Title: Rangeland Monitoring and Analyses (MSU/BSRSI subcontract)

Certification Regarding Debarment, Suspension, and Other Responsibility Matters—Primary Covered Transactions

(1) The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department of agency;

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Certified By:

Fred Salas
(Signature)

MAY 11 2000

(Date)

Fred Salas

(Typed Name)

Sr. Contract and Grant Administrator

(Title)

Michigan State University

(Institution)

certification Regarding Drug-Free Requirements

The grantee certifies that it will provide a drug-free workplace by:

(a) Publishing a statement notifying employees that ~~the~~ unlawful manufacture, distribution, dispensing, possession or use of a controlled substance ~~is prohibited~~ in the grantee's workplace and specifying the actions that ~~will be~~ taken against employees for violation of such prohibition;

(b) Establishing a drug-free awareness program to inform employees about -

- (1) The dangers of drug abuse in the work place;
- (2) The grantee's policy of maintaining a drug-free workplace
- (3) Any available drug counseling, rehabilitation, and employee assistance programs; and
- (4) The penalties that may be imposed upon employees for drug abuse violations occurring in

the workplace;

(c) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a);

(d) Notifying the employee in the statement required by paragraph (a) that, as a condition of employment under the grant, the employee will -

(1) Abide by the terms of the statement and

(2) Notify the employer of any criminal drug statute conviction for a violation occurring in the workplace no later than five days after such conviction.

(e) Notifying the agency within ten days after receiving notice under subparagraph (d)(2) from an employee or otherwise receiving actual notice under subparagraph (d)(2), with respect to any employee who is so convicted-

(f) Taking one of the following actions within 30 days of receiving notice under subparagraph (d)(2), with respect to any employee who is so convicted-

(1) Taking appropriate personnel action against such an employee, up to and including termination; or

(2) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency;

(g) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (a), (b), (c), (d), (e) and (f).

B. The grantee shall insert in the space provided below the site(s) for the performance of work done in connection with the specific grant:

Place of Performance (Street address, city, county, state; zip code)

317 & 318 Manly Miles

Michigan State University
East Lansing, MI 48824

Certified By:



MAY 11 2000

(Signature)

*(Date)

Fred Salas

(Typed Name)

Sr. Contract and Grant Administrator

(Title)

Michigan State University

(Institution)

CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements.

The undersigned certifies, to the best of his or her knowledge and belief, ~~that~~

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loan, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

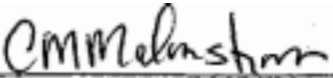
This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, US. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000 for each such failure.


Signature and Date

MAY 11 2000

Fred Salas, Sr. Contract and Grant Administrator
Name and Title of Authorized Representative

Michigan State University
Organization Name


Project Leader, Carolyn Malmstrom and Jiaguo Qi

5/10/00

**PROPOSED RESEARCH SUBCONTRACT WITH AUDUBON-CALIFORNIA
CALFED Bay-Delta Program 2001 Proposal Solicitation (May 15,2000)**

Determinants of successful upland rangeland restoration (Subtask 3.3)

Principal Investigator: Dr. Truman Young
Research Assistant: Megan Lulow
Department of Environmental Horticulture
Graduate Group in Ecology
University of California, Davis

Project 1. Quantitative monitoring and assessment of ongoing restoration efforts in the Union Slough watershed

Hypotheses/Questions:

- 1.1 What are the correlates of success in establishing perennial grasses, and controlling exotic plants across soil types, topographies, seed mixes? (Hypotheses H1 and H2 will be tested on both past and future restoration sites, and hypothesis H3 will be tested at future restoration sites, where baseline vegetation will be measured before restoration treatments.)

H1. Cover and density of the individual native grass species seeded at the site will vary by abiotic factors (soil type, aspect, and slope).

H2. Cover and density of individual native grass species will vary by pre- and post-planting management techniques (burning, disking, fertilization, application of broad spectrum herbicide [Round-Up] after seeding)

H3. Sites with locally severe infestations of particularly intractable invasives (medusahead, goatgrass, filaree, annual ryegrass, wild oats, ripgut brome, and zoorroforescue) will experience less restoration success than adjacent sites.

Restoration practitioners are apparently becoming increasingly successful in recent years in both controlling invasive exotic plants, and in establishing native perennial grasses in northern California grasslands. Unfortunately, much of the evidence for this increased success has gone undocumented (Young 2000). This leaves the restoration methods open to question, reduces the effectiveness of knowledge dissemination, stymies granting agencies that rightfully need documentation of the relative success of their funded projects. In addition detailed quantitative monitoring often reveals patterns that might otherwise be missed, allowing more rapid refinement of management techniques.

Perhaps the greatest impediment to the restoration of native perennial grasses is the pernicious presence of exotic invasive annuals (Brown and Rice 2000, John Anderson, pers. comm.). Herbicides and burning have proven useful in controlling these invasive plants, and in preparing restoration sites (e.g., Ditomaso et al. 1999; J. Anderson, J. Randall, pers. comm.).

One of the dilemmas for restoration ecologists is the knowledge that a) nitrogen supplementation can assist in the establishment of native grasses, and b) broadcast application of nitrogen tends to favor invasive plant even more than natives, for a net deleterious effect (Huenneke et al. 1990; Morgan 1994, Owen & Marrs 2000, Reeve Morghan & Seastedt 1999) One possible solution is the extremely local application of fertilizer at the point of planting of natives, which should benefit them without benefiting the invasives (see Table 1).

Approach

A moderate-scale (170 acres) upland grassland restoration project was established in the Union School Slough watershed in 1999/2000. The site is a mixture of soil types, slopes, aspect. Two additional factors were incorporated into the research design in a controlled replicated fashion: two fertilizer treatments and two pre-emergent herbicide treatments. These treatments were crossed in a way that allow for a full factorial analysis of variance, complete with interaction terms.

We will establish 100-200 sampling plots throughout the 170 acre Union Slough grassland restoration site. The plots will be located in a random stratified design that samples a wide range of natural and experimental variation. Plots will be stratified with respect to soil type, topographic position, and aspect.

We will also monitor vegetation at three sites (each in a different soil type) that were exposed to the replicated fertilizer/herbicide treatments. Five to ten replicated plots will be sampled at each of the four treatment combinations within each of the three soil types, for a total of 60-120 plots.

Within each plot, we will sample plant cover both along a planted furrow, and across the furrows. The former gives a more precise estimate of the success of the planted perennial grasses, and the latter gives an unbiased sample of the overall plant community at the site. A pin frame will be used for accurate measure of aerial cover, counting first hits per pin for each species encountered. We will also record the frequency (in 0.25m² quadrats) of all species. Density of planted perennial grasses will be quantified by counting plants along fixed furrow lengths. Surveys will be carried out four times per year.

Future restoration sites within the broader Audubon proposal will undergo similar monitoring, but we will also quantify baseline @re-restoration)vegetation of the site for comparison. At that time, we will identify and permanently mark areas of particular infestations of intractable weeds (*medusahead*, *goatgrass*, *filaree*, *annual ryegrass*, *wild oats*, *ripgut brome*, and *zorrofescue*) for specific monitoring.

Data Handling and Storage

Data will be entered daily into an Excel data file backed up regularly. These data will later be imported into statistical packages (SAS, JMP, CANOCO) for formal analysis. Both the original data and the analyses will be archived in a form available to other CalFed researchers.

For the replicated controlled studies (of nitrogen and Telar herbicide), we will carry out two-way ANOVAS with interaction terms on the dependent variables of cover by planted native perennial grasses, non-native invasive plants, and non-planted native plants (e.g., *Brodiaea*, *Amsinckia*). We will analyze the broad vegetation surveys using Canonical Correspondence Analysis (CCA), which simultaneously integrates data for species and for sample plots, with environmental and experimental factors as correlated drivers of community structure and species success (Young & Peacock 1992, ter Braak 1996, Huhta & Rautio 1998, Einarsson & Milberg 1999).

Expected Products/Outcomes

This monitoring will provide detailed quantification for the relative success of current restoration practices in California upland grasslands. This will also form the basis for a set of initial protocols for perennial grassland restoration (to be continually updated as our knowledge is refined). Although this research will be carried out within a fairly narrow geographical range, the inclusion of multiple major soil types and a wide variety of other environmental variables across several sites should provide more than a parochial view for developing restoration guidelines.

We will produce yearly interim reports, and a final project report to Audubon and Cal Fed within six months of the end of the contract period. We will also submit our results for publication in the major peer reviewed journals in the field (*Restoration Ecology*, *Environmental Management*, *Ecological Applications*, *Journal of Range Management*). We will also participate in landowner training workshops and field days, and assist in the development of protocols and guidelines for local land owners and livestock managers,

Work Schedule

See attached (both projects combined).

Feasibility

We have already begun initial monitoring of the plots. At first it was difficult to distinguish the various grass species in the seedling stages. However, reference seedling vouchers grown from known seed in greenhouse trays, along with many hours of detailed field observations, have enabled our team to confidently identify all the planted grass species, and nearly all the exotic species. These initial surveys also provide us with realistic estimates for time needed for the kinds of extensive sampling we are proposing (a two person crew can sample approximately 4-6 plots per hour). Initial statistical analyses indicate that our sampling protocol is sufficiently precise and our sample sizes are sufficiently large to identify important patterns.

% Cover	Absent	Present	Difference
Herbicide			
Native perennials	2.35 \pm 0.5	4.90 \pm 0.6	+ 106%
Invasive plants	16.55 \pm 0.7	11.60 \pm 1.2	- 29%
Nitrogen			
Native perennials	3.40 \pm 0.6	3.85 \pm 0.6	+ 13%
Invasive plants	13.90 \pm 0.9	14.20 \pm 1.3	+ 2%

Table 1. Percent cover by planted native perennial grasses and invasive plants in plots subject to two different classes of restoration treatment. Initial analysis of first surveys, April 2000 in one soil type (Corning Red Gravel). It appears that the effects of nitrogen are more pronounced on the Seahorn Series soil (analysis pending). Sample sizes are ten plots for each pair of means (40 plots total).

Budget.

See attached (both projects combined).

Project 2. Enhancing Grassland Diversity and Forage Quality With Native Forbs

Hypotheses/Questions:

2.1 What are the reference species for forb restoration in rangelands?

H1: Nativeforbs have survived invasion by exotic annuals better than have nativeperennial grasses.

H2: These nativeforbs will have environmentalpreferences that can guide their restoration into managed rangelands.

2.2. How do we best establish native forbs, and what are the benefits?

H1: Introduction of nativeforbs will increaseplant communityproductivity (cover) and diversity.

H2: Species diversity will be greater and vegetative cover will be more stable in treatments where nativeforbs are seeded after two years of broadleaf herbicide application, as compared to seeding theforbs at the same time as the grasses

H3: Plots where both nativeforbs andperennial grasses have established will contain significantly less cover of exotic weeds thanplots where both these species have not established.

The productivity and stability of forage are crucial considerations for effective rangeland management. Ecologists have recently provided evidence that plant communities with greater species and functional group (or guild) diversity exhibit greater productivity and stability, as well as efficiency in the use of soil resources (Brown 1998, Tilman et al 1997, reviews by Schlapper & Schmidt 1999, Schwartz et al. 2000). Studies also suggest that the ability for species to coexist is more likely when they are able to partition the way resources are used, such as through

differential rooting depths or season of activity, in addition to variations in environmental characteristics (such as soil type) and disturbances which inhibit dominant competitors from taking over (such as herbivory) (Parrish and Bazzaz 1976, McKane et al 1990, Brown and Rice 2000). In addition, there is evidence suggesting that more functionally diverse communities are better able to resist invasion by other species (Brown and Rice 2000). In the application of these findings to managed systems we need a better understanding of the range of conditions under which coexistence may occur and be sustained.

Introducing legumes and other forbs into the California range system has been recognized as a way to improve year-round forage quality and productivity (Menke 1989). In particular, true clovers (*Trifolium spp.*) provide excellent year-round forage by providing nutrient rich burrs, leaves, and stems, in addition to fixing nitrogen (Menke 1989). Kay (1968, 1969) demonstrated that mixed stands of perennial grasses and (non-native) subclover (*Trifolium subterraneum*) provided forage of greater productivity and of longer year-round duration than fertilized **annual** grassland or annual grassland improved with subclover. The productivity of clovers has been demonstrated to be hampered by annual grass stands that have not been intensively grazed, due to their rapid growth and formation of continuous stands (Menke 1989, Rosiere 1987). The nature of this problem is not likely to occur in native perennial grass stands, which are slower growing and form tufts with interstitial spaces.

Despite of the benefits **annual** legumes can provide, recommended species for range improvement has predominantly been limited to two species of non-native clovers, subclover (*T. subterraneum*) and rose clover (*T. hirtum*) (Menke 1989). In general, forbs vary greatly in extent and density with the timing and amount of precipitation in a given year, yet different species will differ in the extent of their response. This makes establishment of monospecific stands of these forbs a risky endeavor for reliable forage, which could be alleviated by increasing the diversity of species used. In addition, subclover can be toxic to livestock in when consumed in excess (Hickman 1993). Native forbs provide a great opportunity to expand the number of species used for range improvement. Not only are there several species of native legumes which could enhance winter and spring forage, there are other species of summer growing native forbs. These species have been shown to provide a mulch layer that is important for protecting soil from erosion processes and creates a favorable environment for germination in the fall (Duncan 1975, Heady 1988). With recent advancements in the development of successful seeding and establishment techniques for native perennial grasses (Amme and Pitschel 1989, Anderson 1996, 1999), there is much potential for exploring the possibilities under which native forbs may also be restored along with these grasses. Important areas to investigate before management techniques can be recommended include:

- a) the degree to which native perennial grasses are capable of coexisting with each the current recommended non-native forb species and selected native forb species,
- b) the importance of timing in the introduction native forbs to the grassland revegetation process,

- c) the importance of broadleaf herbicide application to the success of establishing native perennial grasses and native forb species, and
- d) the degree to which successful stands of coexisting species deter weeds compared to revegetated grasslands not seeded with native forbs.

Approach

Forb survey:

Central to any restoration effort is the question: what are the reference species? For California grasslands, this has been difficult to establish, in part because the nearly total exclusion of native perennial grasses from so many communities (Hamilton 1986). However, native forbs species appear to have survived (as remnants) within degraded grasslands better than many of the perennial grasses (J. Anderson, pers. com., T. Young, M. Lulow, pers. observations).

We will carry out broad scale surveys throughout the broader watershed, seeking remnant populations of native forbs species, especially those thought to be of value to livestock (*Trifolium*, *Lotus*). We will first survey areas with known populations of native perennial grasses. However, we will also survey grasslands where native perennial grasses have been eliminated. The presence of all native species will be recorded, as well as their relative abundance. We will record such environmental variables as elevation, soil types, slope, aspect, and land use history. We will survey 50-100 sites.

These surveys will help determine the species we use in our forb restoration experiments (below). The surveyed populations will also provide seed sources for the experiments outlined below. Seed will be collected from sites as local as possible, and from sites with similar environmental characteristics.

Forb experiments:

This study will be conducted on the upland grassland areas of the larger watershed restoration project. After a late spring fire targeted at eliminating the weedy annual grass seed production for that year, a broad spectrum herbicide will be applied following germinating rains in the fall. This process is important and standard for seeding of native grasses. Native grass species (see Table 1) will be drill seeded in the larger project area, and 5-10 patches of non-native forbs used as forage will be identified as they germinate in the second round of rains for that year (they typically have a large seed bank that is not eliminated with a single herbicide application early in the season). In selecting patches, we will control for soil type, slope, and aspect. In these patches, 4x4m plots will be set up in a randomized complete block design according to the treatments in Table 2. Forb species were selected based on their biological appropriateness for the upland hills in this region (determined either through personal observation, observations of individuals familiar with the flora in the region, or on distribution and horticultural information provided in Hickman (1993), on their potential for providing suitable forage or contributing to a functionally diverse, compatible complex of species, and on the feasibility of obtaining seed (Table 1). Although these species have potential to be applied to other rangeland improvement

and restoration projects in the region, more information and intensive surveys are needed to explore the range of forb species suitable for these purposes. Care will be taken to calculate even proportions of each species based on seed weight and pure live seed. Seeds of each species will be thoroughly mixed and sewn in a mixture with rice hulls to obtain an even spread across plots.

Table 1: Species provisionally proposed for native perennial grass and nitrogen fixing and non-nitrogen fixing native forb seed mixes. These may be adjusted, based on the forb surveys.

Grasses	N-Fixing Forbs	Other Forbs
<i>Nassella pulchra</i>	<i>Trifolium bifidum</i> (N)	<i>Achillea millefolium</i>
<i>Festuca idahoensis</i>	<i>Trifolium fucatum</i> (N)	<i>Asclepias fascicularis</i> (W), (S)
<i>Elymus elymoides</i>	<i>Trifolium ciliolatum</i> (N)	<i>Eremocarpus setigerus</i> (W), (S)
<i>Poa secunda</i>		<i>Wyethia</i> spp.
<i>Melica californica</i>	<i>Lupinus bicolor</i>	<i>Trichostema lanatum</i>
<i>Bromus carinatus</i>		<i>Hemizonia congesta</i> ssp <i>luzulifolia</i> S
(W)=unsuitable forage, but wildlife value and summer activity; (S)=summer active; N=Nitrogen fixing		

Table 2: Treatments prescribed among plots over a three year period. Native forbs = (F); native grasses = (G); broadleafherbicide(H).

Year	Treatments						
1	G+F	G (H)	G	G (H)	G	G (H)	G
2		F	F	(H)		(H)	
3				F	F		

Data on species richness, cover evenness, composition, and density will be collected for all treatments during peak growing and reproductive periods. Incident light on the ground level will be recorded with photometers and soil moisture and depth will be gathered using gypsum blocks among treatments.

Within each plot, we will sample plant cover both along a planted furrow, and across the furrows. The former gives a more precise estimate of the success of the planted perennial grasses, and the latter gives an unbiased sample of the overall plant community at the site. A pin frame will be used for accurate measure of aerial cover, counting first hits per pin for each species encountered. We will also record the frequency (in 0.25m² quadrats) of all species. Density of planted perennial grasses will be quantified by counting plants along fixed furrow lengths.

Surveys will be carried out four times per year.

Data Handling and Storage

Data will be entered daily into an Excel data file backed up regularly. These data will be imported into statistical packages (SAS, JMP, CANOCO) for formal analysis. Both the original data and the analyses will be archived in a form available to other CalFed researchers.

For the replicated controlled studies (of herbicide treatments and timing of forb planting), we will carry out two-way ANOVAS on the dependent variables of cover by planted native perennial grasses, planted native forbs, non-native invasive plants, and non-planted native forbs. We will analyze the forb surveys using Canonical Correspondence Analysis (CCA), which simultaneously integrates data for species and for sample plots, with environmental and experimental factors as correlated drivers of community structure and species success (Young & Peacock 1992, ter Braak 1996, Huhta & Rautio 1998, Einarsson & Milberg 1999). This analysis can be done on either presence/absence data or more detailed quantitative assessments.

Expected **Products/Outcomes**

Results from this study would provide some of the first scientific information on the feasibility of incorporating native forbs into native grassland restoration and range improvement projects in California. These results will not only have implications for how to achieve successful restorations of diverse grassland communities, but has great implications for improving the forage quality, duration and sustainability of productive rangelands in this region. Specifically, it will provide needed information on the relative productivity and diversity of areas seeded with and without these forbs, information on the suitability of specific native forb species, and techniques important in the establishment phases of such communities.

We will produce yearly interim reports, and a final project report to Audubon and Cal Fed within six months of the end of the contract period. We will also submit our results for publication in the major peer reviewed journals in the field (*Restoration Ecology, Environmental Management, Ecological Applications, Journal of Range Management*). We will also participate in landowner training workshops and field days, and assist in the development of protocols and guidelines for local land owners and livestock managers,

Work Schedule

See attached (both projects combined).

Feasibility

Projects of similar design have been conducted by Megan Lulow who will be the primary researcher for this project. These previous projects have clearly demonstrated the feasibility of establishing and monitoring such plots. Permission for access to private lands in the Willow Slough Watershed will be obtained from the participating landowners through Audubon-California staff.

Budget

See attached (both projects combined).

Cost-Sharing

The University of California is paying the salary of Truman Young, and additional salary support of graduate research assistants, if needed above that funded by CalFed. Considerable equipment is already on hand in Dr. Young's lab, included desk-top computers and printers, GPS units, reference materials, and miscellaneous supplies.

Qualifications

Dr. Truman Young, UC Davis. Professor Young has a B.A. from University of Chicago and a Ph.D., University of Pennsylvania. He is currently an Assistant Professor and Assistant Restoration Ecologist at the University of California, Davis. He created and currently teaches the Restoration Ecology course at UCD. His research interests span a broad range of plant population and community ecology. Over 60 scientific publications in such journals as Ecological Restoration, Ecology, Oecologia, Forest Ecology and Management, Biological Conservation, Conservation Biology, and Restoration and Management Notes. His current research emphasizes human dominated landscapes, rangeland management and habitat restoration.

Literature Cited

Amme, D. 1992. Grassland Restoration in California. Grasslands October issue.

Anderson, J.H. 1999. Direct seeding of California native grasses in the Sacramento Valley and foothills. Pp. 5-11 in P. Robins (ed.), Bring farm edges back to life! Yolo County Resource Conservation District, Woodland, CA, USA.

Anderson, J.H. and J.L. Anderson. 1996. Establishing permanent grassland habitat with California native perennial grasses. Valley Habitats. 14.

Brown CS, Rice KJ. 2000. The mark of zorro: Effects of the exotic annual grass *Vulpia myuros* on California native perennial grasses. *Restor Ecol* 8:10-17.

Brown, C.S. 1998. Restoration of California central valley grasslands: Applied and theoretical approaches to understanding interactions among prairie species. Ph.D. dissertation, University of California, Davis, USA.

Carlsen TM, Menke JW, Pavlik BM. 2000. Reducing competitive suppression of a rare annual forb by restoring native California perennial grasslands. Restoration Ecology 8:18-29.

- DiTomaso, J.M., Kyser, G.B., & Hastings, M.S. 1999. Prescribed burning for control of yellow starthistle (*Centaurea solstitialis*) and enhanced native plant diversity. Weed Sci. 47: 233-242.
- Duncan, D.A. 1975. The San Joaquin site of the grassland biome. Pp. 4-6 ~~in~~ R.M. Love (ed.), The California Annual Grassland Ecosystem. Institute of Ecology, University of California, Davis, CA, USA.
- Einarsson, A., & Milberg, P. 1999. Species richness and distribution in relation to light in wooded meadows and pastures in southern Sweden. Ann. Bot. Fenn. 36: 99-107.
- Hamilton, J.G. 1997. Changing perceptions of pre-European grasslands in California. Madrono 44(4):311-333.
- Hatch DA, Bartolome JW, Fehmi JS, et al. 1999. Effects of burning and grazing on a coastal California grassland. Restor Ecol 7: 376-381.
- Heady, H.F., J.W. Bartolome, M.D. Pitt, G.D. Saville, and M.C. Stroud. 1991. California prairie. Pp. 313-335 ~~in~~ R.T. Coupland (ed.), Ecosystems of the World 8A. Natural Grasslands Intro. and Western Hemisphere. Elsevier, New York, USA.
- Hickman, J.C. 1993. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley, CA, USA.
- Huenneke, L.F. et al. 1990. Effects of soil resources on plant invasion and community structure in California serpentine grassland. Ecology 71:478-491.
- Huhta, A.P. & Rautio P. 1998. Evaluating the impacts of mowing: a case study comparing managed and abandoned meadow patches. Ann. Bot. Fenn 35: 85-99.
- McKane, R.B., D.F. Grigal, and M.P. Russelle. 1990. Spatiotemporal differences in ^{15}N uptake and the organization of an old-field plant community. Ecology 71:1126-1132.
- Menke, J.W. 1989. Management controls on productivity. Pp. 173-199 ~~in~~ L.F. Huenneke and H. Mooney (eds.), Grassland structure and function: California Annual Grassland. Kluwer Academic Publishers, Dordrecht, Netherlands.
- Morgan, J.P. 1994. Soil impoverishment. Restoration and Management Notes 12:55-56.
- Owen, K.M & R.H. Marrs. 2000. Creation of heathland on former arable land at Minsmere, Suffolk, UK: The effects of soils acidification on the establishment of *Calluna* and ruderal species. Biological Conservation 93: 9-18

- Parrish, J.A.D. and F.A. Bazzaz. 1976. Underground niche separation in successional plants. Ecology 57:1281-1288.
- Reever Morghan K.J. & T.R. Seastedt. 1999. Effects of soil nitrogen reduction on nonnative plants in restored grasslands. Restoration Ecology 7:51-55.
- Rosiere, R.E. 1987. **An** evaluation of grazing intensity influences on California ~~annual~~ range. Journal of Range Management 40:160-165.
- Ter Braak, C.J.F. 1996. Unimodal models to relate species to environment. Agricultural Mathematics Group. Wageningen, Netherlands
- Tilrnan, D., J. Knops, D. Wedin, P. Reich, M. Ritchie, and E. Siemann. 1997. The influence of functional diversity and composition on ecosystem processes. Science 277: 1300-1302.
- Young, T.P. & F. Chan. 1998. Establishment of deergrass (Muhlenbergia rigens) at a restoration site, and its prospects for woody plant suppression in transmission rights of way. Grasslands 8(3):3-10.
- Young, T.P. & M.M. Peacock. 1992. Giant senecios and the alpine vegetation of Mount Kenya. Journal of Ecology 80: 141-148.
- Young, T.P. 2000. Restoration ecology and conservation biology. Biological Conservation 92:73-83.
- Young, T.P., J.M Chase & R.T. Huddleston. Two paradigms: succession, community assembly and the process of ecological restoration. Ecological Restoration, in press.

[illegible][illegible][illegible][illegible]

Budget, Young subcontract

Projects 1 and 2: restoration monitoring, and forb experiments
cost

Item	Year 1	Year 2	Year 3	Total
Personnel				
Research assistant support (UC Davis graduate student)*	\$15,780.00	\$15,780.00	\$15,780.00	\$47,340.00
Graduate student fees 9 x \$360 (not subject to overhead)	\$3,240.00	\$3,240.00	\$3,240.00	\$9,720.00
Equipment				
Laptop computer	\$2,500.00	\$0.00	\$0.00	\$2,500.00
Other				
Miscellaneous supplies	\$1,000.00	\$1,000.00	\$1,000.00	\$3,000.00
Travel to professional meetings	\$500.00	\$500.00	\$1,000.00	\$2,000.00
Publication costs (page charges)	\$250.00	\$250.00	\$500.00	\$1,000.00
Transportation to and from Field sites (@ \$0.325/mi)	\$500.00	\$500.00	\$500.00	\$1,500.00
 Total direct costs	 \$23,770.00	 \$21,270.00	 \$22,020.00	 \$67,060.00
Indirect costs (26%** , not applied to equipment or fees)	\$4,687.80	\$4,687.80	\$4,882.80	\$14,258.40
Total costs	\$28,457.80	\$25,957.80	\$26,902.80	\$81,318.40

*12 months x 1315/month

**This is the rate negotiated between U.C. Davis and CalFed

TO

Audubon Society, California State Chapter
555 Audubon Place
Sacramento, CA 95825

SUBMITTING ORGANIZATION

The Regents of the University of California
University of California, Davis
Office of Research, 410 *Mrak* Hall
One Shields Ave.
Davis, CA **95616-8671**

TITLE OF PROPOSED RESEARCH

"Determinents of successful upland restoration"

TOTAL AMOUNT REOUESTED PROPOSED DURATION DESIRED STARTING DATE

\$81,948.40

3 Years

4/01/2001

PRINCIPAL INVESTIGATOR

Dr. Truman Young

DEPARTMENT

Environmental Horticulture

PHONE NUMBER

754-9925

CHECKS MADE PAYABLE TO

The Regents of the University of California


Send Checks to


University of California, Davis
Cashier's Office, 1200 Dutton Hall
Davis, California **95616-8671**

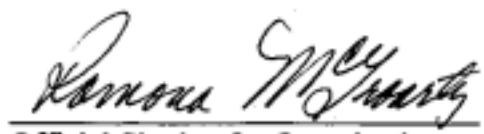
Send Award Notice To

The Regents of the University of California
University of California, Davis
Office of Research, 410 **Mrak** Hall
One Shields Ave.
Davis, Ca **95616-8671**

APPROVALS

 5 May, 2000
PI Signature Date

 5/5/00
Department Chair Date


Official Signing for Organization 5/6/00

Ramona McGroarty
Contracts and Grants Analyst

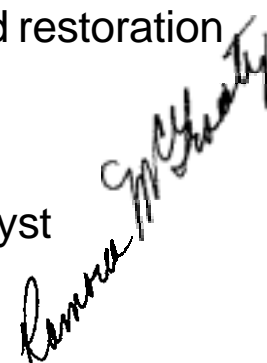
“ATTENTION”

DATE: 8 May 2000

TO: Dr. Truman Young
DEPARTMENT: Environmental Horticulture
PROJECT TITLE: Determinants of successful upland restoration
SPONSOR: Audubon Society
PROJECT NO.: 002184

FROM: Ramona McGroarty, Contract and Grant Analyst

Subject: Proposal Review

A handwritten signature in cursive script, reading "Ramona McGroarty", is written diagonally across the right side of the letter, overlapping the "FROM:" line and the "Subject:" line.

Your attached proposal was received by the OVCR for review on 8 May 2000, allowing less than the requested five working days before the ~~8 May 2000~~ deadline. The proposal was signed without review so that it may meet the sponsor's deadline subject to the following condition:

- You agree to assume full responsibility for errors subsequently identified by the sponsor or the OVCR.

Please contact me at (530) 752-9753 or Alicia Foy at 754-601.0 if there are any questions.

PROPOSED RESEARCH SUBCONTRACT WITH AUDUBON-CALIFORNIA
CALFED Bay-Delta Program 2001 Proposal Solicitation (May 15,2000)

Field and laboratory evaluation of palatability, selectivity and forage quality of native and introduced perennial grasses (Subtask 3.4).

Principle Investigator: Dr. Emilio Laca
Research Assistant: Amanda van Houtte
Department of Agronomy and Range Science
University of California at Davis
Davis, CA

Problem

Palatability of native grass is thought to be quite high (C. Cesmat, NRCS., pers com.) and initial data suggest forage quality of native grasses in the watershed may be equal to or greater than traditional forage species (Wrynski et al 1998). However, a lack of credible scientific data based on local studies is one of the major barriers native grassland restoration in the watershed.

Questions/hypotheses

1. Are native perennial grasses palatable to livestock? Do grazing animals selectively choose among native grass species or between natives and non-natives while foraging?

H1. Grazing animal selectivity will not favor individual native grass species or types of grasses (native versus perennial).

H2. Energy status of livestock individuals, as measured by a calibrated fecal index, will not differ between animals grazed on native versus non-native pasture.

2. How do native perennial grasses compare to nonnative annual grasses in nutritional content throughout the year? Are there differences in forage quality between natural and restored populations of native species?

H1. Forage value of native perennial grasses and nonnative annual grasses ~~will~~ vary seasonally and by species.

H2. Cumulative forage value of native grasses will be higher for native perennial species ~~than~~ annuals.

Approach

Our approach will compare natural and restored stands of natives with nonnative annual forage grasses. It includes field observation of foraging preference (selectivity) along with fecal analysis to provide a "stand-in" measure of palatability, along with laboratory analysis of forage quality of grass samples collected from natural and reseeded areas.

1. Palatability/Selectivity

Observation: Sheep and/or cattle grazing pressure per species will be measured in all reseeded pastures. The condition of individual grasses immediately before and immediately after fall grazing will be recorded. Height and diameter will be recorded for multiple, randomly chosen bunch grasses of each species. Additionally, we will record the number of bites per species that selected animals take during one hour of grazing at three times of the day (morning, noon, evening). After greening up in the fall, one year after being seeded, the bunch grasses are distinct and most easily visible. This should make it possible to observe animals taking bites from individual grasses, whose species identity can be thereafter be determined. The number of bites of each species will be compared to the relative abundance of each species in the pasture to determine selectivity by the animals. The animals used may either belong to the ranch owners, or be supplied by another agency. These observational studies will be repeated the following fall, 2 years after reseeding.

Fecal analysis: Fresh animal feces will be collected three times during the first year (winter, spring, mid-summer) and analyzed for the presence of all species. These samples will be collected both from animals grazing reseeded rangeland and from animals grazing on annual-dominated rangeland, and will reflect the composition of the animals diets for the two weeks prior to collection. Fecal samples will be analyzed in cooperation with the NRCS state office, which is calibrating a new method to estimate the energy status of livestock with a calibrated fecal index (L. Jolley, NRCS, pers.com).

2. Forage quality analysis

Forage "grab" samples of 20 g dry matter each will be collected for selected species from multiple random plants in each location. Both native and common exotic rangeland species will be sampled, including *Nassella pulchra* (or *N. lepida*), *Elymus glaucus*, *Bromus hordeaceus*, and *Lolium multiflorum* (or spp.).

The sampling design will include 2 major landscape positions (top and bottom of hill) within each pasture type that includes native perennial bunchgrasses (2 natural populations of perennials within annual grassland, 2 areas re-seeded to native perennials in 1999, and 2 areas reseeded in 2000). Each combination will be replicated in 2 locations, and sampling will be performed at 6 times each year (late winter, mid spring, late spring, mid summer, late summer, and early winter/fall) to generate seasonal plots of quality and quantity of forage. One reseeded pasture will serve as a collection site for all other species, where 2 samples for each species will be collected 6 times in the year. Both parts of this study will be performed during two consecutive years. Data for the establishment year will not be collected until 2001, on pastures reseeded in fall 2000.

Dept. of Agronomy and Range Science, UCD: Samples will be ground and analyzed according to the Van Soest method for fiber composition. Additionally, content of crude protein, calcium, phosphorus, and sulfur will be performed with elemental analyzers. Invitro digestability of each sampled species will also be performed; net energy will be estimated.

Expected outcomes

We will prepare an interim report with preliminary findings at the end of the ~~first~~ year. A final report will be submitted at the end of the project. We will also work with Audubon-project staff to disseminate our findings to participants in the Willow Slough Rangeland Stewardship program.

Qualifications

Emilio Laca, Ph.D. is a Professor of Range Sciences in the Department of Agronomy and Range Science at the University of California at Davis. An agricultural ecologist, his areas of interest include range management, foraging behavior models on different spatial scales, ungulate impact on plant communities. He ~~has~~ conducted extensive work in central Asia on the application of geostatistics in site specific agricultural practices to minimize impact and optimize production. Dr. Laca received is Ph.D. in 1992 from U.C. Davis.

References

Wrynski, J. P. Robins, and G. Verseart. 1998. Native grass forage quality pilot study. Grasslands 8(2).

Budget, LACA subcontract

Native grass forage quality and palatability

Item	cost		
	Year 1	Year 2	Total
Personnel			
Research assistant support (UC Davis graduate student)*	\$15,780.00	\$15,780.00	\$31,560.00
Graduate student fees 9 x \$360 (not subject to overhead:	\$3,240.00	\$3,240.00	\$6,480.00
Equipment			
Other			
Fecal samples	\$300.00	\$300.00	\$600.00
Laboratory analysis of forage nutrition	\$5,760.00	\$5,760.00	\$11,520.00
Miscellaneous supplies	\$1,000.00	\$1,000.00	\$2,000.00
Meeting costs	\$500.00	\$500.00	\$1,000.00
Transportation to and from Field sites (@ \$0.325/mi)	\$250.00	\$250.00	\$500.00
Printing costs for landowner information pieces	\$500.00	\$500.00	\$1,000.00
Total direct costs	\$27,330.00	\$27,330.00	\$54,660.00
Indirect costs (26%** , not applied to equipment or fees)	\$4,687.80	\$4,687.80	\$9,375.60
Total costs	\$32,017.80	\$32,017.80	\$64,035.60

*12 months x 1315/month

**This is the rate negotiated between U.C. Davis and CalFed

Cost-share

University is paying salary of Emilio Laca

Fecal samples at Texas A & M/NRCS State Office	\$552	552
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PROPOSED RESEARCH SUBCONTRACT WITH AUDUBON-CALIFORNIA
CALFED Bay-Delta Program 2001 Proposal Solicitation (May 15, 2000)

Wildlife monitoring and assessment of perennial grassland and riparian restoration efforts *in* the Willow Slough watershed (Subtask 3.5)

Principal Investigator: Dr. Daniel Anderson
Research Assistant: Jan Goemssen
Graduate Group in Ecology
Department of Wildlife, Fish, and Conservation Biology
University of California, Davis

Questions/Hypotheses:

1. What are the trends of the avian community in response to upland perennial grassland restoration, and how does avian species richness, density and community structure change **as** the system approaches reference (goal) conditions?

H1: Perennial grassland restoration practices will increase avian species richness and density in the restored areas, and there will be a shift from generalist to grassland specialist species as the system approaches reference conditions.

H2: Within the restored areas, the diversity and abundance of grassland specialist species will be greater in more successful restoration sites (area dominated by perennial bunchgrasses) than less successful sites (areas dominated by annual grasses/forbs).

2. How does the installation of supplemental structures, such **as** brush piles and perches, influence avian abundance and species diversity?

H1: Brush piles and perches will increase bird use, abundance and species composition by providing cover, foraging perches, and nesting habitat.

3. What are the trends of the avian community in response to riparian restoration, and how does avian species richness, density and community composition change **as** the system approaches reference conditions?

H1: Restoration practices will increase avian species richness and density within the restored riparian systems.

*H2: Within the restored riparian areas, the avian community composition will shift from generalist to riparian specialist bird species **as** the system approaches reference conditions.*

Degradation and alteration of perennial grasslands and riparian areas has resulted in population declines of many bird species (Strait 1999, Dobkin et al. 1998, Delisle and Savidge 1997). Shifts in vegetative structure and species composition have been reported to contribute to declines of habitat specialist species (Sutter and Brigham 1998, Davis and Baldrige 1980). Grassland specialist species, such **as** Northern Harrier (*Circus cyaneus*), Burrowing Owl (*Atene*

cunicularia), Homed Lark (*Eremophila alpestris*), Lark Sparrow (*Chondestes grammacus*), Grasshopper Sparrow (*Ammodramus savannarum*), may be most affected by the structural differences between **annual** grasses and perennial bunchgrasses (Davis and Baldrige 1980), while vegetative degradation by livestock grazing in riparian areas has led to declines in the riparian avifauna (Dobkin et al. 1998). Habitat restoration, through the establishment of native vegetation and control of exotic species, may support conservation of these species by providing vegetative characteristics that the birds rely on for foraging and reproduction. Monitoring avian species within recently restored sites over time will provide an avenue for evaluating the ability of current restoration practices to provide suitable habitat for specialist bird species.

Approach

Avian response to the upland grassland and riparian restoration, being conducted in the Willow Slough watershed will be monitored through the use of point counts (Bibby et al. 1992). We will establish fixed-radius circular plots as point count stations within recently restored areas and in adjacent unrestored areas of comparable size as controls. Fixed-radius point counts of 50m will be conducted at stations separated by 200m. Point counts will be conducted at each site on consecutive days between the hours of 0530 and 0930, with each site being visited one time per week. Audio recordings of all likely bird species will be reviewed prior to the onset of monitoring to familiarize observers with the songs and calls of local bird species. 8x50 power binoculars will be used to facilitate in visual identification of bird species.

Structural characteristics of vegetation reported in the literature to be important in assessing habitat for birds include vegetation height, canopy cover, vertical density, heterogeneity, depth of litter layer, and percent of bare ground (Weins 1969, Weins and Rotenbeny 1980). We will measure vegetation structure at each point count station to make correlations between bird activity and vegetative characteristics, and investigate whether particular aspects of vegetative structure are being created through the restoration projects. At each station, three 50m transects in random directions will be determined. At three fixed distances (15, 30 & 45m) along each transect a 0.5m pin frame will be used to determine relative vegetation cover, height, heterogeneity, litter depth, and bare ground.

We will also install brush piles and foraging perches throughout portions of recently restored grassland sites and control sites. Structures will be installed and avian use and community composition will be monitored through focal point observations following morning point count censuses. Creation of brush piles has been recommended as a management practice to provide cover and nesting habitat for birds (Gorenzel et al. 1995), and Aigner et al. (1998) reported population increases of avian species in response to the presence of brush piles in harvested woodlands.

All bird records will be placed in one of the following categories:

1. Heard only (bird heard calling but not seen)*
2. Seen only (bird seen but not vocalizing)*
3. Heard and then seen*

4. Seen and then heard*
5. Aerial foraging (bird foraging in area but does not land)
6. Fly by (flying overhead, not utilizing area)

* Use of brush piles or perches will be recorded.

Chi-squared analysis will be used to compare aspects of avian use between restored and non-restored areas and species diversity will be calculated using Simpson's index of diversity. We will correlate components of the vegetative structure with avian use via Canonical Correspondence Analysis. To look at avian use over time, we will use a 2-factor (treatment, year) analysis of covariance. A repeated measures model will be necessary because population trends over subsequent years will not be independent.

Monitoring and Assessment Plans

The avian monitoring component of this project will provide a quantitative assessment of avian use of the restored areas, and may be used **as** an indication of success in providing suitable habitat for grassland and riparian specialist birds. Monitoring procedures will be standardized throughout the project area and results between sites and other CALFED funded projects will be readily comparable.

Point count vegetation measurement data will allow us to:

1. Determine the relative abundance and species composition of birds in the restored areas relative to unrestored areas.
2. Determine how the species are utilizing the restored areas (e.g., foraging, nesting, etc.)
3. Monitor shifts in avian species composition and abundance **as** the restored systems approach reference (goal) conditions.
4. Identify components of vegetation (e.g., height, heterogeneity, litter depth, bare ground) that most influence avian use of restored areas.

Data Handling and Storage

Field data will be recorded on point count data sheets and entered daily into a Microsoft Excel data file. These data will be imported into statistical packages for formal analysis. Data sheets will be photocopied weekly and stored in separate locations. All original data and analysis will be made available to Audubon and CALFED as part of products described below.

Expected Products/Outcomes

Although the habitat preferences of grassland birds are well known (Ehrlich et al. 1988) we have been unable to find studies investigating avian use of restored perennial grasslands in California. To our knowledge, the avian monitoring portion of this project will be the first to quantify avian response to large-scale grassland restoration in California's Central Valley. It will provide a means of evaluating the ability of current grassland restoration practices to provide a particular habitat type that has been lost or severely degraded throughout much of California.

This will be the first formal study that includes brush piles and supplemental perch structures in a grassland restoration to increase the habitat potential of the restored site. Its utility will be evaluated with respect to wildlife benefits the additional structures provide.

We will produce yearly reports, and a final monitoring report to CALFED within six months of the end of the contract period. Our results will be presented annually at the Wildlife, Fish, and Conservation Biology seminar series at UC Davis and submitted for publication in major peer reviewed journals in the field. We will also participate in landowner training workshops and conduct bird walks for landowners on field days.

Work Schedule

Preliminary avian censuses have been conducted at recently restored perennial grassland and riparian sites by Jan Goerrissen to obtain pretreatment data. Formal monitoring will begin in the spring of 2001 and will continue through the contract period of Spring 2004 (3 years). Data will be analyzed yearly for incorporation in annual reports. Avian monitoring will be conducted weekly throughout the contract period.

Feasibility

Point counts conducted with fixed-radius plots provide an accurate means of identifying what species are present in an area and give a quantifiable, unbiased approach to monitoring avian species and abundance. When coupled with measurements of vegetative structure around the point count station, inferences can be drawn about the habitat selection and preferences of individual species and community assemblages (Bibby et al. 1992). Preliminary avian censuses through point counts have already been conducted by the primary research assistant at a recently restored grassland site, and all species observed in the area on a casual basis have also been recorded in the point counts (Goerrissen, unpub. fieldnotes). The study is designed to be flexible if access to a particular project site is not available.

Qualifications

Dr. Dan Anderson, UC Davis. Dr. Anderson did a Bachelor's of Science in Zoology at North Dakota State University, received his M.S. degree in Wildlife Ecology, then went on to earn a PhD. degree at the University of Wisconsin in 1971 in Wildlife Ecology and Zoology. In 1976, Anderson joined the faculty at the University of California Davis' Department of Wildlife, Fish and Conservation Biology and has been there ever since, continuing his contaminant work and conducting long-term studies of seabird populations, El Niño effects, human disturbance effects, marine bird habitat selection, migration and movements of seabirds, and related work, much of it in Baja California and the Gulf of California. He is a former Director of the Ecotoxicology Program at UC Davis and former Chair of his department. He currently teaches an undergraduate course in Wildlife Ecotoxicology and a graduate seminar in Ecotoxicology, as well as having served as Chairperson of the Ecotoxicology "area of emphasis" in the Ecology Graduate Group at UCD. Dr. Anderson's current research involves studies of contamination effects, distribution, and dynamics of organic and inorganic materials in birds from California and Baja California

coastal and wetland environments, including the Klamath Basin, Clear Lake, San Joaquin Valley, and Rio Colorado Delta/Gulf of California region. Anderson is also actively involved in the conservation and management of avian populations and their habitats.

Cost-share

The University of California is paying the salary of Daniel Anderson.

Contact information:

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Graduate Group in Ecology
Wildlife, Fish and Conservation Biology
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Dr. Dan Anderson
Wildlife, Fish and Conservation Biology
University of California, Davis
Ph. (530) 752-2108
dwanderson@ucdavis.edu

References

- Aigner, P.A., W.M. Block, and M.L. Morrison. 1998. Effect of firewood harvesting on birds in a California oak-pine woodland. *Journal of Wildlife Management* 62(2): 485-496.
- Bibby, C.J., N.D. Burgess, and D.A. Hill. 1992. Bird Census Techniques. Academic Press Ltd., London. 257 pp.
- Davis, J. and A. Baldrige. 1980. The Bird Year; a book for birders with special reference to the Monterey Bay area grassland. Boxwood Press, Pacific Grove, California. 114-123.
- Delisle, J.M., and J.A. Savidge. 1997. Avian use and vegetation characteristics of Conservation Reserve Program fields. *Journal of Wildlife Management* 61(2): 318-325.
- Dobkin, D.S., Rich, A.C., and W.H. Pyle. 1998. Habitat and avifaunal recovery from livestock grazing in a riparian meadow system of the northwestern great basin. *Conservation Biology* 12(1): 209-221.
- Ehrlich, P.R., D.S. Dobkin and D. Wheye, 1988. The Birders Handbook. Simon and Shuster, New York. 785 pp.
- Gorenzel, W.P., S.A. Mastrup, and E.L. Fitzhugh. 1995. Characteristics of brushpiles used by birds in northern California. *Southwestern Naturalist* 40: 86-93.
- Strait, D. 1999. Native grasses and their value for wildlife habitat enhancement. *Grasslands* 9: 1-13.

Sutter, G.C., and R.M. Brigham. 1998. Avifaunal and habitat changes resulting ~~from~~ conversion of native prairie to crested wheat grass: patterns at songbird community **and** species levels. *Canadian Journal of Zoology* 76: 869-875.

Wiens, J.A. 1969. **An** approach to the study of the ecological relationships of grassland birds. *Ornithological Monograph* 8: 1-93.

Wiens, J.A. and J.T. Rotenberry. 1985. Response of breeding passerine birds to rangeland alteration in a North American shrubsteppe locality. *Journal of Applied Ecology* 22: 655-668.

Budget, Andersen subcontract

Monitoring avian response to restoration

Item	Cost			Total
	Year 1	Year 2	Year 3	
Personnel				
Research assistant support (UC Davis graduate student) ¹	\$15,780.00	\$15,780.00	\$15,780.00	\$47,340.00
Graduate Student fees 9 x \$360 (not subject to overhead:	\$3,240.00	\$3,240.00	\$3,240.00	\$9,720.00
Equipment				
Binoculars	\$850.00	\$0.00	\$0.00	\$850.00
Other				
Audio cassette of bird calls	\$45.00			\$45.00
Statistical programs	\$100.00			\$100.00
Equipment rental	\$500.00	\$500.00	\$500.00	\$1,500.00
Miscellaneous supplies	\$500.00	\$500.00	\$500.00	\$1,500.00
Transportation to and from Field sites (@ \$0.325/mi)	\$325.00	\$325.00	\$325.00	\$975.00
Total direct costs	\$21,340.00	\$20,345.00	\$20,345.00	\$62,030.00
Indirect costs (26%**; not applied to equipment or fees)	\$4,576.00	\$4,317.30	\$4,317.30	\$13,379.60
Total costs	\$25,916.00	\$24,662.30	\$24,662.30	\$75,409.60

¹12 months x 1315/month^{**}This is the rate negotiated between U.C. Davis and CalFed

"ATTENTION"

DATE: 12 May 2000

TO: Dr. Daniel W. Anderson

DEPARTMENT: Wildlife Fish & Conservation Biology

PROJECT TITLE: Avian response to restoration in the Willow Slough watershed

SPONSOR: Audubon Society, California Chapter

PROJECT NO.: 002245

FROM: Ramona McGroarty, Contract and Grant Analyst

Handwritten signature: Ramona McGroarty

Subject: Proposal Review

Your attached proposal was received by the OVCR for review on 11 May 2000, allowing less than the requested five working days before the 15 May 2000 deadline. The proposal was signed without review so that it may meet the sponsor's deadline subject to the following condition:

- You agree to assume full responsibility for errors subsequently identified by the sponsor or the OVCR.

Please contact me at (530) 752-9753 or Alicia Foy at 754-6010 if there are any questions.

To

Audubon Society, California State chapter
555 Audubon Place
Sacramento, CA 95825

Submitting Organization

The regents of the University of California
Office of Research, 410 Mrak Hall
One Shields Ave
Davis, CA 95616

Title of Proposed Research

Avian response to Restoration in the Willow Slough Watershed

Total Amount Requested

\$75,409.60

Proposed duration

Three Years

Desired Starting Date

February 2001

Principal Investigator

Dr. Daniel W. Anderson

Department

Wildlife, Fish and Conservation

Phone

752-2108

Make checks payable to

The regents of the University of California

Send Checks to

University of California, Davis
Cashier's Office
1200 Dutton Hall
Davis, CA 95616

Send award notice to

The regents of the University of California
Office of Research, 410 Mrak Hall
One Shields Ave
Davis, CA 95616



Principal Investigator

5/10/00

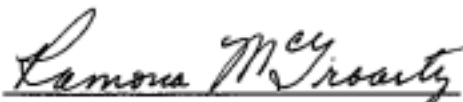
Date



Department Chair

5/11/00

Date



Official Signature for Organization

5/12/00

Date

Ramona McGroarty
Contracts and Grants Analyst

**PROPOSED RESEARCH SUBCONTRACT WITH AUDUBON-CALIFORNIA
CALFED Bay-Delta Program 2001 Proposal Solicitation (May 15,2000)**

**Field-based Research on Plant and Soil Response to Restored Native
Perennial Grasslands Versus Non-native Annual Grasslands (Subtask 3.6)**

Principal Investigators:

Dr. Stephen Griffith and Dr. Jeffrey Steiner
National Forage Seed Production Research Center
USDA-ARS, Corvallis, OR

Problem

Rangeland resources in the Willow Slough Watershed have been degraded by more *than* 100 years of intensive sheep and cattle grazing and poor land management practices that have reduced diversity of plant species and cover, reduced infiltration and increased rainfall run-off, accelerated erosion, and degraded riparian habitats. The native perennial grass species that once comprised the native California grasslands, evolved under extensive grazing pressure from native herbivores. Disturbance from livestock grazing and fire exclusion has greatly altered the grasslands flora that once occupied the Central Valley and surrounding foothills of California (Daubenmire, 1978). Overgrazing by cattle and horses resulted in the displacement of *Nassella pulchra* and associated other perennial grass species by introduced Mediterranean annual species such as *Avena*, *Bromus*, and *Hordeum*. Nonnative annual grass species are lower in biomass and ground cover *than* perennials, increasing the potential for runoff, erosion, and weed invasion and reducing soil water and nutrient retention. Since approximately 25% of pollutants in rivers and 15% in lakes are sediments from agricultural land, factors that improve infiltration or reduce soil erosion and runoff contribute to protecting surface water non-point pollution (Baker and Laflan, 1982; Carey, 1991).

No single tool is better or more cost-effective than establishing plant cover for conserving and stabilizing soil and improving soil health. Perennial forages play a dominate conservation role on about 445.8 million ha, or 48.5% of the landmass of the **US** (SCS, 1987). Yet, there is little information of how native perennial grasses under California rangeland and climate conditions affect biotic and abiotic factors compared to non-native annual grass systems. It has been shown that the bulk of the C and N in tallgrass prairies of the mid-west are stored below ground and exceed forest soils in C and N per unit volume (Seastedt and Knapp, 1993). Roots and rhizomes are the major storage organs for C and N (Hayes and Seastedt, 1987; Ojima, et al., 1994) and contribute to new plant growth. Unlike perennial grasses, annual grasses must rely on available soil nutrients, post-germination, each new season. **Annuals** generally have shallower roots systems than perennial grasses and thus are unable to tap deeper soil moisture and nutrients, **as** do perennial grasses. The ability of perennial grasses to maintain nutrient reserves and attain deeper soil water enables these grasses to provide earlier fall re-growth and biomass compared to annuals.

Further, roots are important in improving water infiltration because they spread through the soil. Perennial grass roots are often longer and penetrate the soil deeper *than* annual grasses. As roots die and decay roots channels form and help water penetrate the soil.

Soil quality and nutrient cycling and availability affect rangeland ecosystem structure and dynamics, and in turn affect ecosystem processes such as production and decomposition. Nutrient availability limits grassland production (Owensby et al., 1970), plant species composition (Tilman, 1987; Gibson et al., 1993; Wedin and Tilman, 1993; 1996), affect physiological responses to the environment, determine nutritional quality for herbivores (Allen et al, 1976), and influence rates of litter decomposition (Pastor et al., 1987; Seastedt et al., 1992). In addition, fire, grazing, soil disturbance, site history, as well as climate and topography, all affect nutrient processing (Turner et al., 1997).

Biotic and abiotic studies related to soil health and nutrient cycling are critical to assess the benefits of native perennial grass restoration to California rangelands and to transfer this information to landowners and conservationists, so land management decisions can be science based.

Hypotheses to be tested in this USDA-ARS work plan

H1. Rangeland restoration using deep-rooted native perennial grasses will improve grassland ecosystem health and reduce rangeland erosion potential by improving soil water percolation and retention, reduce soil compaction, enhance nutrient use efficiency, and ensure vigorous re-growth compared to annual grassland systems.

H2. Establishment of native perennial grasses will result in a reduction in the annual weed seed bank over time, suggesting enhanced competition from native grasses resulting from improved soil quality, enhanced shading, and presence of soil surface plant litter by grass swards.

Approach and Methodology for Hypothesis 1 Rangeland restoration using deep-rooted perennial grasses will improve soil health and reduce erosion potential by improving soil water percolation and retention, reduce soil compaction, enhance C and N sequestration, and ensure vigorous re-growth compared to annual grassland systems.

Site and Treatment Descriptions: Four rangeland sites have been selected and contrast in stage of rangeland restoration. One site has been in annual grass production for decades; another was burned and reestablished in 1999 to native perennial grass species; the third site is a six-year old re-established native perennial grass rangeland, and the last a historic native perennial grass rangeland. These sites are located in the low-lying foothills of the inner Coast Range of the southern Sacramento Valley in Yolo County, California and part of the Willow Slough watershed that extends to the Sacramento River. The watershed has Mediterranean climate with cool, wet winters, and hot dry summers. Annual precipitation varies from 18 to 25 inches annually. There is a rain shadow effect from the Coastal Range that creates only half as much precipitation at the eastern

end of the watershed. About 83% of the annual precipitation occurs between November and March. Soils at all sites are a Sehorn-Balcom complex. These soils are well drained. Permeability is slow in the Sehorn soil and moderately slow in the Balcom soil. Surface runoff is medium to **high** for both soils. The available water holding capacity is 15 to 20 cm for the Sehorn and 10 to 15 cm for the Balcom soil. The effective rooting depth is 60 to 100 cm. Natural fertility is moderate to **high**.

Statistical analyses. Our approach will be based on comparisons among four research sites that differ in restoration stage. The comparisons will include four randomly selected plots within each restoration treatment (described above). Replicated plots will be 10m x 10m and will be fenced to prevent grazing. We will specifically test hypotheses that determine the nature, magnitude, and direction of the soil and plant responses to perennial grassland restoration compared to annual grassland systems.

Nitrogen (**N**) and Carbon (**C**) Cycling. Changes in N and C mineralization processes will be determined using an in situ buried bag method (Eno, 1960). Replicated incubations will be renewed every six weeks; nine per year. Briefly, an intact soil core will be removed, sealed within a zip-seal polyethylene bag, and replaced in its original position in the ground. A second core will be taken for determination for initial inorganic N ($\text{NO}_3\text{-N}$ and $\text{NH}_4\text{-N}$) and C analyses. Sub-samples of soil will be taken for determination of soil moisture by gravimetric methods and soil microbial biomass. Soil biomass C will be determined using the chloroform fumigation extraction method described by Horwath et al. (1994). Total organic carbon will be quantified with high temperature catalytic combustion and infrared detection on a Rosemount/Dohrman DC-190. Soil pH will be measured using a glass electrode (1:2, soil: water ratio). Soil organic matter (total C) will be determined on a Perkin Elmer 2400 Series II CHNS/O analyzer after removal of carbonates with 1 M HCl (not good for these soils they have high carbonates and many expanding clays that trap water, use combustion technique). Air and soil temperature and precipitation are factors that have been shown to affect N cycling and will be measured continuously using a Campbell Scientific data logger. Since nutrient cycling processes are governed to a large extent by soil oxidation and reduction characteristics, soil Eh will be measured with triplicate Pt electrodes installed at two depths (25 and 45 cm) along established transects. The electrodes will be read according to Austin (1993) on a **high** impedance voltmeter.

Soil Abiotic Properties. Within each of the three replicated quadrates in each restoration stage treatment, multiple soil cores will be sampled along transects and analyzed for water retention and soil bulk density. Soil water retention curves will be determined as described by Klute (1986) using a suction cell apparatus (Soil moisture Equipment Corp., Santa Barbara, CA). Water retention curves and bulk density will be performed in Year-1 and Year-3. Soil bulk density will be determined as described by Blake and Hartge (1986). Soil compaction will be

measured using a penetrometer (Eijkeamp Agrisearch Equipment, The Netherlands) several times a year to capture contrasting soil moisture levels.

Plant N and Biomass Accumulation. To estimate mineralized N available to the grass sward, above- and below-ground plant material will be sampled from randomly selected quadrants and total N determined. These data will be compared with temporal soil N and mineralization process data to determine relationships between soil N availability, plant uptake, and various soil physical parameters. Plant growth stage will be recorded throughout the season. Plant material will be ground using a Tecator Cyclotec 1093 sample mill and analyzed for total N using a Perkin Elmer 2400 Series II CHNS/O analyzer.

N Leaching. Nitrate-N and ammonium-N leached from the major root zone (0-30 cm) will be captured using suction cup lysimeters installed at approximately 60 cm below the soil surface. Water samples will be analyzed for nitrate-N and ammonium-N as described above.

Approach and Methodology for Hypothesis 2. Establishment of native perennial grasses will result in a reduction in the annual weed seed bank over time, indicating enhanced competition from native grasses resulting from by improved soil quality, enhanced shading, and presence of soil surface plant litter by grass swards.

The size and composition of the weed seed bank as well as the above-ground flora reflect the impact of past and present management practices (Roberts, 1981; Cardina et al., 1991). In general, large seed banks are associated with arable sites (Fenner, 1995), and its composition is richer than the composition of plants that cover it (Symonides, 1986). The viable seed fraction in the seed bank is the main source of weed recruitment and infestation in fields (Cavers and Benoit, 1989). The amount of species diversity within seed banks increases by disturbance (Feldman et al., 1997).

Methods. Soil weed seed bank core sampling, preparation, and assay. The soil seed bank will be sampled by removing 20 to 30 five-cm diameter cores, spaced 1 m apart, from the soil surface to a depth of seven-cm along two V-shaped pattern transects in each treatment to be sampled. The soil cores will be air-dried in paper bags and stored at approximately 20° C until analyzed for seed content.

The soil cores will be broken by hand and ground for two seconds in a grinder (Custom Laboratory Equipment, Orange City, FL). Approximately 250 ml by volume of ground soil will be added to 325 ml of vermiculite (grade #4) and mixed (Burrell Scientific, Pittsburgh) for 30 seconds at 300 shakes min⁻¹. The mixed samples will then be placed in plastic zip-lock-bags with 250 ml of deionized water. The hydrated samples will be stored in a dark growth chamber (Percival Model E-54, Boone, IA) for 10 days at 5° C to break secondary seed dormancy. After stratification, each sample will be spread in aluminum trays (20

x 20 cm) to a depth of three cm \pm 1 cm depth. The trays will be placed at random on greenhouse benches and maintained at 20° C \pm 2 and 18° C \pm 2 (day and night, respectively). Natural light will be supplemented with high intensity light (PPF of 170 $\mu\text{mol m}^{-2} \text{s}^{-1}$) for 14 hours day⁻¹. The samples in the trays will be lightly watered daily or when necessary to maintain uniform wetness. Each soil sample will be subjected to three to five cycles of sample drying for seven days, hydrating, seedling emergence and counting, and soil stirring. Preliminary experiments with samples from Central California indicated that three cycles generally depleted the seed bank of readily non-dormant, viable seeds as has been reported by others (Lush, 1988). An inventory of weed seedlings have been identified and confirmed by growing seedling reference samples to a stage of development that was easily recognized. Reference seedling samples representative of all identified and unidentified species are maintained in a herbarium.

Statistical analyses. The weed seed species data from the soil cores will be transformed using [$\log_{10} (x+1)$] to adjust for heterogeneity of variance and non-additivity (Mulugeta and Stoltenberg, 1997). Differences in treatments among transformed means will be separated using Fisher's protected least significant difference test. The treatment means calculated from log-transformed values will be inversely transformed using the antilogarithm [$\text{antilog}_{10} (x-1)$] for interpretation.

Data Handling and Storage

All personnel engaged by this project will keep updated and accurate records in the form of notebooks. All non-automated data will be logged on standardized data sheets. All automated data collected will be printed or, if possible, immediately transferred into a computer spreadsheet (EXCEL 5.0, Microsoft Corp.). All data logged onto data sheets or printed out onto hard copy, will be immediately photocopied and entered into a computer spreadsheet. Eventually all data will be entered in EXCEL 5.0 spreadsheet where it can be managed and statistically analyzed. All data entered into the computer will be backed up on harddisk memory and on floppy disks and CDs that will be produced in duplicate and stored at separate distant locations.

All personnel will be required to report on their progress on a monthly basis. Principal investigators (Griffith and Steiner) will be responsible for synthesizing interpretive summaries of their data and providing these summaries to project manager [California Audubon]. The principal investigators, according to the guidelines established by Cal Fed/Audubon, will file reports. The project manager will then be responsible for synthesizing all information into one integrated report for Cal Fed.

Expected **Products/Outcomes**

This research will determine the effects of non-native annual versus native perennial grass restoration on California rangeland soil and plant ecology. Conservationists and landowners will use this information to make science-based management decisions that will improve rangeland biodiversity and quality habitat for wildlife, assure high water quality, and improve landowner economic sustainability. Concepts learned from these studies should be able to be applied to most rangeland ecosystems.

Interim project reports will be provided Audubon and Cal Fed on an annual basis and a final project report prepared and distributed within six months of the end of the contract period. Research data will be published in peer-reviewed scientific journals, USDA-ARS and university annual reports and extension bulletins, newsletters, press releases, and web media. Oral and poster presentations will be presented at local, regional, national, and international conferences and landowner training workshops.

Work Schedule

Site Establishment. All sites will be established and instrumented within one month after funding has been received.

Nitrogen and Carbon Cycling. *In situ* mineralization-nitrification-immobilization, soil gravimetric soil moisture, soil microbial biomass, microbial C, total soil organic matter C, soil pH, and redox experiments/measurements will be conducted approximately nine times a year for three years beginning at the start of funding.

Soil hydraulic and other physical properties. Soil water retention curves and soil bulk density will be generated from each site in Year-1 and Year-3 the study. Soil compaction will be determined several times (at least four) each year for three years.

Plant N and Biomass Accumulation. Below- and above-ground plant biomass will be sampled each year for three years when the major grass species are at peak flowering. Total plant biomass accumulation data will be collected as described in the MSU work plan.

N Leaching. Water samples will be taken from suction cup lysimeters at least nine times per year for three years.

Feasibility

Feasibility that this research can be completed on time and without technical or weather related factors is demonstrated by the investigator's published research from completed related projects.

Qualifications

Stephen Griffith

National Forage Seed Production Research Center, **USDA-ARS, Corvallis, OR**

B.S., 1980, Education/Botany, Utah State University, Logan, UT

MS., 1985, Plant Science, Utah State University, Logan, UT

Ph.D., 1986, Plant Physiology, University of Minnesota, St. Paul, MN

Dr. Griffith has been a Research Plant Physiologist with USDA-ARS since 1986. Currently, he serves as a team member and leader of groups of scientists addressing sustainable grass seed cropping systems with emphasis on small ~~farm~~ sustainability. Generally, his research is directed at optimizing economic and environmental factors associated with nutrient use, reduced tillage, and post-harvest residue management. Specific research involves the soil biogeochemistry of agricultural and unmanaged lands as it relates to N and C cycling, riparian zone function in improving water quality, N management of grass systems, and applying site-specific process and biogeochemical information in a landscape context. Recent accomplishments include: the development of optimal fertilizer N timing, rate, and N-source practices for grass seed crops in western Oregon; improved understanding the physiology of N use by grasses grown for seed; better understanding the temporal and spatial components of N and C cycling in grass seed production systems and adjacent riparian zones and their relationship to crop fertility and water quality. Dr. Griffith's role (**0.5 FTE**, USDA-ARS cost-share) on ~~this~~ project will be to conduct experiments associated with Hypothesis 2, analyze data, report findings, and disseminate information gathered to end-users to facilitate implementation of conservation practices.

Jeffrey J. Steiner, **USDA-ARS**. Dr. Steiner has conducted research that determines the impact of environmental and agronomic factors on the developmental biology and productivity of forage and turf seed cropping systems. He has also developed approaches to more efficiently utilize diverse genetic resources held in *ex situ* forage legume germplasm collections using biochemical markers and **GIS** databases. In addition to developing a complete package of production components for red clover seed production systems, he has investigated ways to produce perennial grass seed crops with maximal amounts of post-harvest residues and using no-till establishment in the absence of open-field burning. His most recent research involves designing a computer decision aid that assesses the economic viability and environmental impact of alternative cropping systems.

Budget

Cal Fed Budget for Hypothesis 1.

Item	Year 1	Year 2	Year 3	Total Costs
Salaries				
0.50 FTE Laboratory Technician (GS-7)	\$14,132	\$14,698	\$15,286	\$44,116
Benefits (30% of salary)	\$4,240	\$4,409	\$4,586	\$13,235
Travel	\$1,000	\$1,000	\$1,000	\$3,000
Supplies				
Laboratory	\$11,766	\$11,766	\$11,766	\$35,298
Publishing	\$200	\$200	\$200	\$600
Office	\$250	\$250	\$250	\$750
Sub-total	\$12,216	\$12,216	\$12,216	\$36,648
Service contracts				
Equipment				
Overhead (Federal rate, 10% of total)	\$3,159	\$3,232	\$3,309	\$9,700
Total	\$34,747	\$35,555	\$36,397	\$106,699

Cost-Share Budget for Hypothesis 1.

Item	Year 1	Year 2	Year 3	Total Costs
Salaries & Benefits				
0.5 FTE Scientist	\$46,800	\$48,672	\$50,619	\$146,091
1.0 FTE Technicians	\$45,000	\$46,800	\$48,672	\$140,472
0.3 FTE Part-time labor	\$4,680	\$4,867	\$5,062	\$14,609
Travel	\$1,000	\$1,000	\$1,000	\$3,000
Supplies				
Laboratory	\$3,400	\$3,400	\$3,400	\$10,200
Service contracts				
Equipment				
Upgrade existing ion analyzer	\$37,500			\$37,500
Lysimeters	\$4,800			
Soil Temperature/humidity & weather stations	\$1,800			
Soil probes	\$750			\$750
Total	\$145,730	\$104,739	\$108,753	\$359,222

Cost-Share Budget for Hypothesis 2.

NOTE: No funds are being requested of CalFed at this time Cost-share is from USDA-ARS, Corvallis, OR.

Item	Year 1	Year 2	Year 3	Total Costs
Salaries & Benefits				
0.1 FTE Scientist	\$11,500	\$11,960	\$12,438	\$35,898
0.1 FTE Technician	\$4,800	\$4,992	\$5,192	\$14,984
0.1 FTE Technician	\$6,500	\$6,760	\$7,030	\$20,290
Travel	\$1,500	\$1,500	\$1,500	\$4,500
Supplies	\$1,000	\$1,000	\$1,000	\$3,000
Service contracts				
Equipment				
Total	\$25,300	\$26,212	\$27,160	\$78,672

Literature Cited

- Albertson, M.L. and D.B. Simons. 1964. Fluid Mechanics. Section 7 *In*: V.T. Chow (ed.), Handbook of Applied Hydrology. McGraw-Hill Book Co., New York.
- Allen, L., L.H. Harbers, R.R. Schalles, C.E. Owensb, and F.F. Smith. 1976. Range burning and fertilizing related to nutritive value of bluestem grass. *J. Range Management* 29: 30-308.
- Baker, E.L. and J.M. Laflan. 1982. Effect of crop residue and fertilizer management on soluble nutrient runoff losses. *Trans. A m . Soc. Eng.* 25: 44-48.
- Blair, J.M., T.R. Seastedt, C.W. Rice, and R.A. Ramundo. 1998. Terrestrial nutrient cycling in tallgrass prairie. *In*: Knapp. A.K., J.M. Briggs, D.C. Hartnett, S.L. Collins (eds.). Grassland Dynamics – Long-Tern Ecological Research in Tallgrass Prairie. Oxford University Press, NY. p. 222-243.
- Blake, G.R. and K.H. Hartge. 1986. Bulk density. *In*: R.W. Weaver et al. (ed.) Methods of Soil Analysis: Part 1 –Physical and Mineralogical Methods. SSA Book Ser. 5. SSSA, Madison, WI.
- Buhler, D.D., and T.C. Mester. 1991. Effect of tillage system on the emergence depth of giant foxtail (*Setaria faberi*) and green foxtail (*Setaria viridis*). *Weed Sci.* 39:200-203.
- Cardina, J., E. Regnier, and K. Harrison. 1991. Long-term tillage effects on seed banks in three Ohio soils. *Weed Sci.* 39:186-194.
- Carey, A.E. 1991. Agriculture, agriculture chemicals, and water quality. *In*: Agriculture and the Environment, USDA Yearbook of Agriculture. Washington D.C.; Gov. Print. Off., p. 78-85.

- Cavers, P.B., and D.L. Benoit. 1989. Seed bank in arable land. *In*: Leck, M.A., V.T. Parker and R.L. Simpson (ed.). Ecology of soil seed banks. Academic Press, New York. p. 309-328.
- Chauvel, B.J., J. Gasquez, and H. Darmency. 1989. Changes of weed seed bank parameters according to species, time and environment. *Weed Res.* 29:213-219.
- Daubenmire, R. 1978. Plant geography. Academic Press. New York.
- Eno, C.H. 1960. Nitrate production in the field by incubating the soil in polyethylene bags. *Soil Sci. Amer. Proc.* 24:277-279.
- Feldman, S.R., C. Alzugaray, P.S. Torres, and P. Lewis. 1997. The effect of different tillage systems on the composition of the seed bank. *Weed Res.* 37:71-76.
- Fenner, M. 1995. Ecology of seed banks. p. 507-528. *In* Kiegel, J. and G. Galili (ed.) Seed development and germination, Marcel Dekker, Inc., New York.
- Gibson, D.J., T.R. Seastedt, and J.M. Briggs. 1993. Management practices in tallgrass prairie: large- and small-scale experimental effects on species composition. *J. Applied Ecology* 30: 247-255.
- Hayes, D.C. and T.R. Seastedt. 1987. Rot dynamic of tallgrass prairie in wet and dry years. *Canadian J Bot* 65: 787-791.
- Horwath, W.R. and E.A. Paul. 1994. Methods of determining soil biomass. *In* R.W. Weaver et al. (ed.) Methods of Soil Analysis: Part 2 - Microbial and Biochemical properties. SSA Book Ser. 5. SSSA, Madison, WI.
- Horwath, W.R., J.J. Steiner, S.M. Griffith, L.F. Elliott, J.A. Field, P.J. Bottomley, J.E. Baham, and P.J. Wigington. 1995. Riparian Ecosystems and Water Quality in Northwest Agricultural Landscapes: USEPA Quality Assurance Plan (Project No. DW12936582-01-1). U.S. Environmental Protection Agency, Corvallis, OR
- Klute, A. 1986. Water retention: Laboratory methods. *In* R.W. Weaver et al. (ed) Methods of Soil Analysis: Part 1 - Physical and Mineralogical Methods. SSA Book Ser. 5. SSSA, Madison, WI.
- Lush, W.M. 1988. Biology of *Poa annua* in a temperate zone golf putting green (*Agrostis stolonifera*/*Poa annua*) .II. The seed bank. *J. Appl. Ecology*, 25:989-997.
- Moss, S.R. 1985. The survival of *Alopecurus myosuroides* Huds. seeds in soil. *Weed Res.* 25:201-211.
- Mulugeta, D., and D.E. Stoltenberg. 1997. Weed and seed bank management with integrated methods as influenced by tillage. *Weed Sci.* 45:706-715.
- National Research Council. 1993. Soil and water quality: An agenda for agriculture. National Academy Press, Washington D.C.
- Owensby, C.E., R.M. Hyde, and K.L. Anderson. 1970. Effects of clipping and supplemental nitrogen and water on loamy upland bluestem range. *J. Range Management* 23: 341-346.
- Ojima, D.S., D.S. Schimel, W.J. Parton, and C.E. Owensby. 1994. Long- and short-term effects of fire on nitrogen cycling in tallgrass prairie. *Biochemistry* 24: 67-84.
- Pareja, M.R., and D.W. Staniforth. 1985. Soil-seed microsite characteristics in relation to seed germination. *Weed Sci.* 33:190-193.
- Pastor, J., M.A. Stillwell, and D. Tilman. 1987. Little bluestem litter dynamics in Minnesota old fields. *Oecologia* 72: 327-330.
- Robins, P. 1999. Bring farm edges back to life! Yolo County Resource Conservation District, Woodland, CA.

- Schweizer, E.E., and R.L. Zimdahl. 1984. Weed seed decline in irrigated soil after six years of continuous corn (*Zea mays*) and herbicides. *Weed Sci.* 32:76-3
- Seastedt, T.R., W.J. Parton, and D.S. Ojima. 1992. Mass loss and nitrogen dynamics of decaying litter of grasslands: the apparent low nitrogen immobilization potential of root detritus. *Canadian J. Botany* 70: 384-391.
- Seastedt, T.R. and A.K. Knapp. 1993. Consequences of non-equilibrium resource availability across multiple time scales: the transient maxima hypothesis. *American Naturalist* 141: 621-633.
- Soil Conservation Service (SCS). Summary Report, 1987. National Resources Inventory. Washington D.C.: SCS.
- Symonides, E. 1986. Seed bank in old-field successional ecosystems. *Ekologia Polska* 34:3-29. Champaign, IL.
- Tilman, D. 1987. Secondary succession and patterns of plant dominance along experimental nitrogen gradients. *Ecological Monographs* 57: 189-214.
- Turner, C.L., J.M. Blair, R.J. Shartz, and J.C. Neel. 1997. Soil N and plant responses to fire, topography, and supplemental N in tallgrass prairie. *Ecology* 78: 1832-1842.
- Wedin, D.A. and D. Tilman. 1993. Competition among grasses along a nitrogen gradient: initial conditions and mechanisms of competition. *Ecological Monographs* 63: 199-229.
- Wedin, D.A. and D. Tilman. 1996. Influence of nitrogen loading and species composition on carbon balance of grasslands. *Science* 274: 1720-1723.
- Willow Slough Watershed Integrated Resources Management Plan. 1996. Jones & Stokes Associates, Inc. Sacramento, CA
- Yenish, J.P., J.D. Doll, and D.D. Buhler. 1992. Effect of tillage on vertical distribution and viability of weed seed in soil. *Weed Sci.* 40:429-433.

Appendix 3.

Letters of Support and Interest

PRESIDENT
Duane Chamberlain

FIRST VICE-PRESIDENT
Casey Stone

SECOND VICE-PRESIDENT
Eric Paulsen

SECRETARY/TREASURER
Denise Sugara

American Farm Bureau Federation/California Farm Bureau Federation

YOLO COUNTY FARM BUREAU

P.O. Box 1556, Woodland, California 95776
(530) 662-6316 • FAX (530) 662-8611

May 11, 2000

Judy Boshoven
Audubon Society-California
221 W. court St. #1
Woodland, CA. 95695

Dear Ms. Boshoven:

The Yolo County Farm Bureau is pleased to support National Audubon Society-California (Audubon) and Yolo County Resource Conservation District (Yolo RCD) efforts to secure additional program funding for conservation practice development and implementation activities within the Willow Slough Watershed.

We have been pleased to participate with the Yolo RCD over the years as it worked with farm and ranch cooperators to solve watershed problems without limiting growers' and ranchers' operational and economic choices. The addition of Union School Slough Watershed Improvement Program in 1998, initiated by Audubon, is working effectively with the RCD and local landowners and operators to address resource issues, while providing wildlife habitat and improving water quality.

We feel strongly that the RCD and Audubon have a clear vision of, and are demonstrating daily, how agriculture and the environment can work together to meet multiple, and often competing, goals. We are excited by the opportunity to gain additional funding for demonstration projects, basic resource assessments, farming and wildlife data, and practical conservation tools the agricultural community needs to continue making improvements to our farms, ranches, and watersheds. Our cooperative efforts have proven extremely useful to a number of our members and we look forward to what is yet to come.

Sincerely,



Duane Chamberlain
President



United States
Department of
Agriculture

Natural
Resources
Conservation
Service

221 W. Court Suite 1
Woodland, CA 95695
(530)662-2037 X 3
Phil.Hogan@ca.usda.gov

May 8,2000

Judy Boshoven
C/o Yolo County Resource Conservation District
221 W. Court Suite 1
Woodland, CA **95695**

Dear Ms. Boshoven:

The USDA Natural Resources Conservation Service (NRCS) located in the Yolo County Service Center is pleased to support the Audubon Society in its grant proposal for the Willow Slough Rangeland Stewardship Program.

This Program will be vital in building partnerships among landowners, public agencies, and conservation organizations to identify shared priorities and to streamline conservation and restoration measures to restore them. The NRCS has worked closely with the Audubon Society and the Yolo County Resource Conservation District over the past year ~~on~~ the Union School Watershed Improvement Program.

Protection of the resources in the upper watershed of Yolo County is important if resource problems on the valley floor are going to be solved. This Program would help to implement the Willow Slough Integrated Resources Management Plan developed by the RCD in **1996**. If this Program is implemented, a model could be made for other agencies and groups to follow that would take an integrated approach to solving problems relating to non-native invasive species in rangeland, protecting ~~oak~~ woodlands, using livestock to increase biodiversity, and improving the economic viability of our rural communities.

Thank you for your consideration of supporting this effort which would assure a Londoner-driven program to improve the natural resources, and thus, the quality of life for all of Yolo County's citizens.

Sincerely yours



PHIL HOGAN
District Conservationist

May 4, 2000

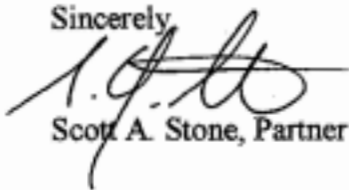
Mrs. Judy Boshoven
Watershed Coordinator
Audubon-California
C/O Yolo County RCD
221 W. Court Street, Suite 1
Woodland, Ca. 95695

Dear Judy:

Thank you for your call the other day. Of course I am interested in supporting Audubon California and the Yolo County Resource Conservation District in their grant proposals. My family owns a 7,500 acre cattle ranch, and have participated in developing projects for habitat enhancement of stockponds, and prescribed burning of grasslands to control weeds under the Union School Watershed Improvement Program. We have been extremely pleased with the assistance that program provided in securing cost-share funding from the Department of Fish and Game's Wildlife Conservation Board for our projects.

I understand that, if the proposals are funded, I would possibly have the opportunity to continue to continue to work with Audubon, the RCD, and others to determine Additional appropriate range-land improvement projects and conservation measures for our property. We are interested in using remote sensing technology and ground-based monitoring to assess forage production and quality and developing conservation plans for our ranches.

Sincerely,



Scott A. Stone, Partner

**YOLO LAND & CATTLE COMPANY
37874 COUNTY ROAD 28
WOODLAND, CA. 95695**

DANIEL B. HRDY, M.D.
21440 ROAD 87
WINTERS, CALIFORNIA 95694
PHONE (530) 661-9225 FAX (530) 661-3633

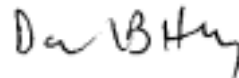
April 24, 2000

Judy Boshoven
Watershed Coordinator
Audubon-California
221 W. Court St., Ste. 1
Woodland, CA 95695

Dear Ms. Boshoven,

We support the goals of the proposed Willow Slough Rangeland Stewardship project for which **you** are seeking funding. We own 1,080 acres in the Willow Slough watershed and are interested in working with your organization, the Yolo County Resource Conservation District, and others to determine appropriate, voluntary conservation measures that will help restore our land to better environmental and economic health.

Sincerely,



Daniel B. Hrdy, M.D..

DBH/gm

Ronald Timothy Farming

17470 Willow Oak Way
Woodland, CA 95695
Office (707) 678-2869
Fax (707) 678-6594
Mobile (530) 304-3335

May 11, 2000

Judy Boshoven
Watershed Coordinator
Audubon-California
C/O Yolo County RCD
221 West Court Street, Suite 1
Woodland, CA 95695

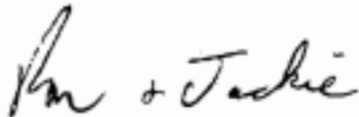
Dear Judy:

As a landowner of 660 acres on the upper Union School Slough watershed I am pleased to **support** the Audubon **Society along** with **Yolo Co. RCD** in their grant proposal.

I am very interested in improving the range through controlled burning and controlled grazing. Erosion control is another **big factor for** consideration. Water development for **livestock** and wildlife is an important **part of** the overall plan, which **will create plant and animal** diversity.

I am willing **to work** jointly with my **neighbors** to develop a watershed-wide project to enhance the environmental quality of the area.

Sincerely



Ron & Jackie Timothy

May 3, 2000

Judy Boshoven
Watershed Coordinator
Audubon-California
221 W. Court Street

~~Dear~~ Ms. Boshoven:

Thank you for taking the time to write to keep us informed on your progress on rangeland restoration in the Willow Slough area. Becky and I very much support the goals of your program, and would like to voice our support for continued funding for your program.

As we expressed last fall, we continue to be interested in working with your organization to improve the environmental health of the 200 acres of rangeland that we own on Road 26. In particular, we are interested in mitigation of the invasion of non-native plants, especially yellow star thistle and medusa head. We also are interested in fencing the **riparian** zone on our property for the purposes of wildlife habitat restoration, and appreciate your advice on the best methods to accomplish that. It is our goal to eventually establish a small pond on the creek to support the area wildlife.

Please continue to keep us informed of your progress. We would ask that you ~~try~~ to provide us with as much advance notice as possible when informing us of your meetings so that we might schedule our attendance.

Sincerely Yours



Bob Paasch
110**NE** Thousand Oaks Drive
Corvallis, OR 97330

May 3, 2000

Judy Boshoven
Watershed Coordinator
Audubon-California
c/o Yolo County RCD
221 W. **Court** Street, Suite 1
Woodland CA **95695**

Dear Judy:

My partners and I are pleased to support the Audubon **Society** and the Yolo County Resource Conservation ~~District~~ in their grant proposals. We **own** a cattle ranch in the upper watershed of Union School **Slough**.

Under the **Union** School Slough Watershed Improvement Program, we have fenced an approximately 50-acre riparian pasture, and have begun to plant areas ~~within~~ the pasture with native trees. The program has also assisted **us** with conducting experiments **to** control streambank and gully erosion, and implementing prescribed burns and reseeding **with** native perennial grasses.

If the next-phase of the program is funded, we would be especially interesting using remote sensing technology and ground-based monitoring to assess forage production and quality and developing conservation plans for our property. We would also be interested in the possibility of conducting additional prescribed burns, and enhancing stockponds for wildlife habitat. We understand that if the program is funded it ~~will~~ provide Audubon and the Yolo RCD with expanded opportunities to monitoring existing conservation activities **on** our ranch to potentially improve the success of such projects in the watershed.

Sincerely,



Richard Stewart

May 7, 2000

Mark Delwiche
1241 Mojave av.
Idaho Falls ID
83404

Judy Boshoven
Watershed Coordinator
Audubon-California
221 W. court st. Ste. 1
Woodland, CA
95695

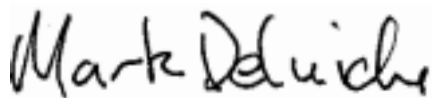
Dear Ms. Boshoven:

I would like **you** to know I support the goals of the proposed Willow Slough Rangeland Stewardship **project** for which you are seeking funding.

I own **25** acres in the Willow Slough watershed, at the west end of the county maintained portion of Rd, **26** in Yolo County. I **am** interested in working with **your** organization, the Yolo County Resource Conservation District, and others **to** determine appropriate, voluntary conservation measures that **will** help restore **my** land **to** better environmental and economic health.

Please keep **me** informed on all developments and meetings. I look **forward** to hearing from you and plan to participate insofar as **I** can from the distance of Idaho **Falls**.

Sincerely



Mark Delwiche

May 5, 2000

Judy Boshoven

Watershed Coordinator

Audubon - California

221 W. Court St. Ste. 1

Woodland, CA 95695

Dear Ms. Boshoven:

I support the goals of the proposed Willow Slough Rangeland Stewardship project for which you are seeking funding.

I own 200 acres in the Willow Slough watershed and am interested in working with your organization, the Yolo County Resource Conservation District, and others to determine appropriate, Voluntary conservation measures that will help restore my land to better environmental and economic health.

I am particularly interested in wildlife ponds, and prescribed burning. I think that the brush in this area is totally taking over the land.

I think that the land is a waste right now.

By burning this brush you will create food for wildlife and livestock, you will bring back natural springs and water flow. I think

there has been a reduction in wildlife
due to the overgrowth of brush, and poor
water flows.

Sincerely,

Gilda McElroy

Rt 1 Box 179-L

Salmon, Id 83467

Appendix 4.

Compliance with Standard Terms and Conditions

A. Letter from Audubon's legal council regarding requirements for contractor's license and bidder's bond

B. Nondiscrimination Compliance
(from Audubon and subcontractors)

C. Non Collusion Affidavit

D. Federal Form 424

National Audubon Society—California

May 13, 2000

CALFED Bay-Delta Program Office
1416 Ninth Street, Suite 1155
Sacramento, CA 95814

RE: Contractor's Licenses and Bonding Requirements for 2001 CALFED Proposal Solicitation Package

To Whom It May Concern:

The implementation of conservation and restoration activities (Task 2 of scope of work) proposed in Audubon-California's "Willow Slough Watershed Rangeland Stewardship Program" will include the following general practices:

- 1) Prescribed burning of grasslands and shrublands
- 2) Seeding native perennial grasses
- 3) Mowing for weed control
- 4) Spraying herbicides for weed control
- 5) Erecting fences to exclude livestock from riparian corridors and stock ponds
- 6) Planting riparian trees and shrubs (from container and cuttings)
- 7) Installing and operating above-grade drip irrigation systems at planted areas
- 8) Installing erosion control mats and other biotechnical materials
- 9) Installing solar pumps, tanks, and livestock troughs at stock ponds

In e-mail communications with CALFED staffperson Rebecca Fawver, I asked the following question:

"The PSP requires that any grant applicants who are going to engage in 'construction projects' must have proof of contractor's license and bidder's bonds. Audubon will be submitting a grant application to do a series of projects on mostly private farm and ranch land in the Willow Slough Watershed which is a continuation of the work which we are currently conducting via our Local Watershed Stewardship Grant #98-E13.

My question is that we will be proposing a series of activities for habitat restoration on farms and ranches which I believe fall under the exemption to a contractor's license via Business and Professions Code Section 7049 for agricultural activities. If our activities fall within this exemption, would this enable us to avoid having to show proof of contractor's license and bidder's bonds?"

The response from your staff was:

"We understand that some restoration project may not involve construction or fall under an exemption. Explain in your application why your project falls within the exemption. No proof of contractor's license or bidder's bond would be required."

Section 7049 of the California Business and Professions Code provides an exemption from the statutory requirements for "Contractors" for "Irrigation; reclamation or fire prevention district work; agricultural work; water well drilling." For the purposes of our proposal, we believe that items 1-8 listed above fall within the language and legal interpretation by the courts of this section.

Specifically, Section 7049 states that "This chapter does not apply to any construction or operation incidental to ...fanning, dairying, agriculture, viticulture, horticulture, or stock or poultry raising, or clearing or other work upon land in **rural** districts for fire prevention purposes, except when performed by a licensee under this chapter."

All of the activities we have proposed for funding from CALFED have dual purposes: to introduce new, sustainable fanning and ranching practices to existing agricultural operations and to improve habitat conditions on these lands. Therefore, we believe that all of our activities are "incidental to" legitimate, ongoing fanning and ranching activities and therefore covered by the exemption of Section 7049 (see Kelly v. Hill (App 4 Dist 1951) 104 Cal. App. 2d 61 and Fraenkel v. Bank of America Nat. Trust and Sav. Ass'n (1953) 40 Cal. 2d 845).

For item #9 (Installing solar pumps at stockponds) we believe this "construction" activity probably is not covered by Section 7049, and would require a licensed contractor to complete this work. We have not identified a subcontractor at this time. If awarded a grant from CALFED, we will comply with all competitive bidding requirements established by the state and/or federal contracts. Attached please find the existing subcontractor form that we are using under our current grant administered by the National Fish and Wildlife Foundation. If possible, we would like to use this form for any subcontracts established under this new proposal for construction activities not covered by the Section 7049 exemption.

If, for any reason CALFED staff determine that the activities 1-8 we have listed above do not fall within the contractor law exemptions of Section 7049, Audubon-California will establish a contractor-subcontractor relationship approach to conduct these tasks and to satisfy all licensing, bonding and other legal requirements of state and federal law.

If you have any questions or need more information, please do not hesitate to contact me at 916/481-5332.

Sincerely,

John McCaull
Attorney at Law
National Audubon Society-California

SUBCONTRACTOR FORM

2/99-B

THIS AGREEMENT is hereby made between National Audubon Society, Inc. ("Client") and _____ ("Independent Contractor" or "IC") according to the following terms and conditions:

1. **CLIENT:** Client is identified as follows:

Name: National Audubon Society, Inc.
Address: 700 Broadway
New York, NY 10003

Business Telephone: (916) 481-5332

2. **INDEPENDENT CONTRACTOR:** The Independent Contractor ("IC") is identified as follows:

Name:
Type of Entity: () Sole Proprietorship
() Partnership () Corporation
() Individual
() Other _____

Address:

Business Telephone:
Employer Identification Number or Social Security Number: _____
License Number 2nd Expiration Date, if any: _____

3. **WORK TO BE PERFORMED:** IC shall perform the following services for Client (add attachment if necessary):

4. **TERMS OF PAYMENT:** Client shall pay IC according to the following terms and conditions:

Client is exempt from Federal Excise Taxes and is also exempt from state and local sales or use taxes. IC agrees that it has not included such taxes in the payments to be made by Client.

5. **TERM OF AGREEMENT:** This Agreement will take effect on _____ and shall terminate on _____; provided that the agreement shall not become effective until fully executed by both parties and approved by the National Fish and Wildlife Foundation.

6. **REIMBURSEMENT OF EXPENSES:** Client shall not be liable to IC for any expenses paid or incurred by IC unless otherwise agreed in writing and provided that any such expenses have been approved in advance and IC submits complete documentation therefor.
7. **INDEPENDENT CONTRACTOR:** IC, and its officers, agents and employees shall in the performance of the Agreement act in an independent capacity and not as officers, employees or agents of the CALFED Agencies, EPA Region 9, or the National Fish and Wildlife Foundation. IC shall supply, at IC's sole expense, all equipment, tools, materials and/or supplies to accomplish the work agreed to be performed. IC shall be responsible for the payment of United States FICA, FUTA, other self-employment taxes and all federal, state, local and, if applicable, foreign income taxes with respect to the Compensation paid to IC by Client and shall indemnify and hold harmless Client against claims made in respect thereto. IC acknowledges and agrees that IC shall not be entitled to receive from Client any statutory or fringe benefits of any kind, including without being limited to those extended by Client to its own employees. IC is not eligible to claim or collect unemployment insurance benefits based on work performed as an independent contractor for Client. No workers' compensation insurance shall be obtained by Client concerning IC or the employees of IC. IC shall comply with the workers' compensation law concerning IC and IC's employees. IC declares that IC has complied with all federal, state, and local laws regarding business permits and licenses that may be required to carry out the work to be performed under this Agreement.
8. **NO AUTHORITY TO BIND CLIENT:** IC has no authority to enter contracts or agreements on behalf of Client unless agreed to in writing. This Agreement does not create a partnership, joint venture or agency relationship between the parties hereto.
9. **RIGHTS IN DATA:** All data and information obtained and/or received under grant shall be in the public domain. IC shall have right to disclose, disseminate and use, in whole or part, any final form data and information received, collected and developed under this agreement, subject to inclusion of appropriate written acknowledgment of credit to the National Fish and Wildlife Foundation, CALFED, and all cost sharing partners for their financial support. Use of draft data requires pre-approval by the Foundation and CALFED. IC shall not sell or grant rights to a third party who intends to sell such product as a profit-making venture.
10. **NO USE OF NAME:** IC shall not use the name of the Client or the name of any employee in any written manner for any purpose whatsoever without Client's prior written consent.
11. **REPRESENTATIONS AND WARRANTIES:** IC represents and warrants that (i) the Materials were originally and specifically developed by IC for Client in fulfillment of this agreement; (ii) no part of the Materials will infringe upon or violate any patent, copyright, trade secret, trademark, nondisclosure or any other proprietary or property rights of any third party; (iii) IC is financially responsible and experienced in and competent to perform the type of work required hereunder and it is familiar with all applicable laws, ordinances and regulations governing the work required hereunder; (iv) IC has the full power and authority to enter into and perform this Agreement and to grant the rights granted hereunder.
12. **REVIEW AND APPROVAL:** Client shall review all work performed under this Agreement and shall have final approval of all decisions relating to the creation or production of the Materials.
13. **EMPLOYEE PERFORMANCE:** Should Client be dissatisfied with the work of employees of IC, Client may require IC to substitute different qualified subgrantees or employees. IC must approve such substitutions in advance of the substitute subgrantee providing services.

14. **CONFIDENTIALITY:** IC shall treat as confidential all data, records and accounts, information, operations, policies, procedures, personnel, marketing plans or prospects and all other information, which becomes known to it through its activities hereunder and which is not otherwise in the public domain or rightfully obtained from another source. During the term and after termination of its services to Client, IC shall not use or disclose any such protected information, IC shall obtain from all sources, third parties or subcontractors utilized by it in producing its product hereunder a signed written statement agreeing to the provisions of this Article.
15. **FINANCIAL RECORDS:** Client shall have the right to audit all financial records of IC pertaining to Client. All financial records must be maintained separately from all other accounts.
16. **SUFFICIENT USE OF PRECAUTION:** If IC, either as principal, or by its agents, contractors, or employees, enters upon the premises or property of Client in connection with the services provided pursuant to this agreement, IC hereby covenants and agrees to take, use, provide and make proper, necessary, and sufficient precautions, safeguards, and protection against the concurrence or happening of any accidents, injuries (including death), damages, or hurt to any person or property during progress thereof. The Project Grantee shall conduct all work consistent with professional standards for the industry and type of work being performed under the Agreement.
17. **INDEMNIFICATION:** IC agrees to indemnify, defend and hold harmless Client, the CALFED Agencies, EPA region 9, National Fish and Wildlife Foundation and their officers, agents and employees from any and all claims and losses accruing or resulting to any or all grantors, subgrantees, material persons, laborers, and any other person, firm or corporation furnishing or supplying work, services, materials or supplies in connection with the performance of this Agreement, and from any and all claims and losses accruing or resulting to any person, firm or corporation who may be injured or damaged by IC in the performance of this agreement.
18. **INSURANCE:** IC shall procure and maintain the following insurance with the following coverages and minimum limits until three months after completion of the Services by the IC:
- (a) Certificates of Insurance. IC shall pay for and deliver to Client within 10 days after this Agreement is executed, and before commencing Services, certificates of insurance. Said certificates of insurance, on standard forms issued by IC's insurers or authorized representatives of IC's insurers, shall be sufficient to evidence coverage. In the event IC fails to deliver said certificates of insurance and performs Services under this Agreement, Client may cancel the Agreement on 10 days notice, and Client shall be relieved of all liability to IC regardless of any work performed or materials furnished unless, within such 10-day period, IC delivers said certificates of insurance to Client.
- (b) Coverage. IC shall provide and maintain in full force, the following insurance coverages, unless otherwise noted, in not less than the following amounts:
- (i) Workers Compensation and Employers Liability Insurance, including occupational disease, disability benefit, and other similar insurance required by applicable law, with a minimum limit of \$100, 000 per accident, per employee;
- (ii) Comprehensive General Liability Insurance with a combined single limit of \$1, 000, 000 per occurrence, and

\$2, 000, 000 general aggregate for bodily injury, including death, product liability and property damage;

(iii) Comprehensive Automobile Liability Insurance (owned, non-owned, and Hired) with a combined single limit of \$1, 000, 000 for bodily injury, including death, and property damage; and

(iv) Excess Liability (Umbrella) Insurance with limits of \$3, 000,000 per occurrence and aggregate.

(c) Client Named As Additional Insured. Comprehensive General Liability Insurance, Comprehensive Automobile Liability Insurance, and any Excess Liability policies shall be endorsed to name Client as an additional insured and shall be written to cover claims incurred, discovered, manifested or made during or after expiration of the contract. The insurance required pursuant to this Article shall be primary coverage; any insurance Client may purchase shall be excess and noncontributory.

(d) Full Coverage Availability. IC represents and warrants that no claims have been made to date under the insurance policies evidenced by the certificates of insurance. IC shall notify Client immediately of any claims made under its insurance policies evidenced by the certificates of insurance.

(e) Policy Expiration. In the event that the insurance policies evidenced by the Certificates of insurance will expire during the term of this Agreement, IC shall deliver to Client, at least 30 days before said insurance policies expire, new certificates of insurance that conform with and are subject to the requirements, representations, and warranties of this paragraph.

19. **TERMINATION WITHOUT CAUSE:** Without cause, Client may terminate this Agreement after giving 30 days written notice to IC of its intent to terminate without cause.

20. **TERMINATION WITH CAUSE:** With reasonable cause, Client may terminate this Agreement effective immediately upon the giving to IC of written notice of termination for cause. Reasonable cause shall include but is not limited to:

- A. material violation of this Agreement;
- B. any act exposing Client to liability to others for personal injury or property damage.

21. **NOTICES:** Any notice given in connection with this Agreement shall be given in writing and shall be delivered either by hand to the party or by certified mail, return receipt requested, to the party at the party's address stated herein. Any party may change its address stated herein by giving notice of the change in accordance with this paragraph.

22. **NON-WAIVER:** The failure of either party to exercise any of its rights under this Agreement for a breach thereof shall not be deemed to be a waiver of such rights or a waiver of any subsequent breach.

23. **ENTIRE AGREEMENT:** This is the entire agreement of the parties with respect to the subject matter hereof and supersedes all prior agreements.

24. **AMENDMENTS:** This Agreement may be supplemented, amended or revised only in writing by agreement of the parties and approved by the National Fish and Wildlife Foundation.

25. **SEVERABILITY:** If any part of this Agreement shall be held unenforceable, the rest of this Agreement will nevertheless remain in **full** force and effect.
26. **NO ASSIGNMENT:** IC acknowledges that the services to be performed by IC for Client are of a personal nature, and IC agrees not to assign this Agreement, in ~~whole~~ or in part, to any other person or entity without the prior ~~written~~ consent of Client, CALFED and the Foundation.
27. **FEDERAL LAW AND REGULATIONS:** Accepting these funds renders IC subject to all terms and conditions of appropriate OMB Circulars (Section XIII), such as allowable costs and cost principles. IC must comply with all applicable federal ~~laws~~ and regulations imposed on individuals and organizations receiving federal funds, including equal opportunity ~~employment~~, the Americans ~~with~~ Disabilities Act, and drug-free work ~~place~~ requirements. IC's financials management system must comply with internal control requirements including, but not limited to, cash receipts, cash disbursements, indirect costs, procurement, labor costs, and interest earned on federal funds.

The parties hereto have executed this Agreement as of the latest date shown below.

NATIONAL AUDUBON SOCIETY, INC.

Supervisor

Date: _____

James A. Cunningham
Sr. V.P. Finance & Administration

Date: _____

INDEPENDENT CONTRACTOR:

Name of IC

By: _____
Title:

Date: _____

NONDISCRIMINATION COMPLIANCE STATEMENT

STD. 19 (REV. 3-95)

COMPANY NAME

National Audubon Society, Inc.

The company **named** above (hereinafter referred to as "prospective contractor") hereby certifies, unless specifically exempted, compliance **with** Government Code Section **12990** (a-f) and California Code of Regulations, Title **2**, Division **4**, Chapter 5 in matters relating to reporting requirements and the development, implementation and maintenance of a Nondiscrimination **Program**. Prospective contractor agrees not to unlawfully discriminate, harass or allow harassment against any employee or applicant **for** employment because of sex, race, color, ancestry, religious creed, national **origin**, physical disability (including HIV and AIDS), medical condition (cancer), age (over 40), **marital** status, denial of family care leave and denial of pregnancy disability leave.

CERTIFICATION

I, the official named below, hereby swear that I am duly authorized to legally bind the prospective contractor to the above described certification. I am fully aware that this certification, executed on the date and in the county below, is made under penalty of perjury under the laws of the State of California.

OFFICIAL'S NAME

James A. Cunningham


DATE EXECUTED

May 12, 2000

EXECUTED IN THE COUNTY OF

New York

PROSPECTIVE CONTRACTOR'S SIGNATURE



PROSPECTIVE CONTRACTOR'S TITLE

PROSPECTIVE CONTRACTOR'S LEGAL BUSINESS NAME

NONDISCRIMINATION COMPLIANCE STATEMENT

STD. 12 (REV. 3-95)

COMPANY NAME

U.S.D.A. - Agriculture Research Service

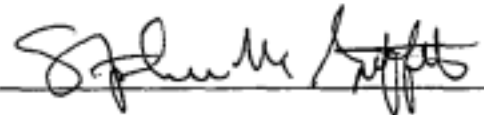
The company named above (hereinafter referred to as "prospective contractor") hereby certifies, unless specifically exempted, compliance with Government Code **Section 12990(a-f)** and California Code of Regulations, Title 2, Division **4**, Chapter **5** in matters relating to reporting requirements **and** the development, implementation and maintenance **of** a Nondiscrimination **Program**. Prospective contractor **agrees** not to unlawfully discriminate, **harass** or allow harassment against any employee or applicant for employment because of **sex**, race, color, ancestry, religious creed, national **origin**, physical disability (including HIV and **AIDS**), medical condition (cancer), age (over 40), marital **status**, denial of family **care** leave **and** denial of pregnancy disability leave.

CERTIFICATION

I, the *official* named below, hereby swear *that* I am *duly* authorized to legally bind the prospective contractor *to the* above described *certification* I am fully aware that this *certification*, *executed on the* date and in *the* county below, *is made* under penalty *of* perjury under the *laws of the* State *of* California.

OFFICIAL'S NAME

Dr. Stephen M. Griffith



DATE EXECUTED

8 May 2000

EXECUTED IN THE COUNTY OF

PROSPECTIVE CONTRACTOR'S SIGNATURE

PROSPECTIVE CONTRACTOR'S TITLE

PROSPECTIVE CONTRACTOR'S LEGAL BUSINESS NAME

STATE OF CALIFORNIA

NONDISCRIMINATION COMPLIANCE STATEMENT

STD. 18 (REV. 5-89)

COMPANY NAME

Michigan State University

The company named above (hereinafter referred to as "prospective contractor") hereby certifies, unless specifically exempted, compliance with Government Code Section 12990 (a-f) and California Code of Regulations, Title 2, Division 4, Chapter 5 in matters relating to reporting requirements and the development, implementation and maintenance of a Nondiscrimination Program. Prospective contractor agrees not to unlawfully discriminate, harass or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religious creed, national origin, physical disability (including HIV and AIDS), medical condition (cancer), age (over 40), marital status, denial of family care leave and denial of pregnancy disability leave.

CERTIFICATION

I, the official named below, hereby swear that I am duly authorized to legally bind the prospective contractor to the above described certification. I am fully aware that this certification, executed on the date and in the county below, is made under penalty of perjury under the laws of the State of California.

OFFICIAL'S NAME

Paulette Granberry Russell

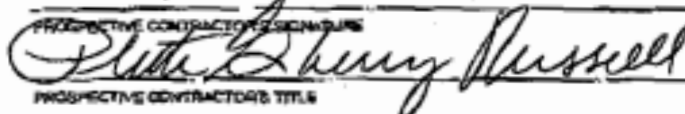
DATE EXECUTED

May 15, 2000

EXECUTED IN THE COUNTY OF

Ingham (State of Michigan)

PROSPECTIVE CONTRACTOR'S SIGNATURE



PROSPECTIVE CONTRACTOR'S TITLE

Paulette Granberry Russell, Director of Affirmative Action Compliance and Monitoring

PROSPECTIVE CONTRACTOR'S LEGAL BUSINESS NAME

Michigan State University

NONDISCRIMINATION COMPLIANCE STATEMENT

STD. 19 (REV. 3-95)

COMPANY NAME

University of California

The company named above (hereinafter referred to as "prospective contractor") hereby certifies, unless specifically exempted, compliance with Government Code **Section** 12990(a-f) and California Code of Regulations, Title 2, Division **4**, Chapter **5** in matters relating to reporting **requirements** and the development, implementation and **maintenance of** a Nondiscrimination Program. Prospective contractor agrees not to unlawfully discriminate, **harass** or allow harassment against any employee or applicant for employment because **of sex**, race, color, ancestry, religious creed, national origin, physical disability (including H N and **AIDS**), medical condition (cancer), age (over 40), **marital status**, denial of family **care** leave and denial of pregnancy disability leave.

CERTIFICATION

I, the official named below, hereby swear that I am duly authorized to legally bind the prospective contractor to the above described certification. I am fully aware that this certification, executed on the date and in the county below, is made under penalty of perjury under the laws of the State of California.

OFFICIAL'S NAME

Regents of the University of California

DATE EXECUTED

5/8/00

EXECUTED IN THE COUNTY OF

Yolo

PROSPECTIVE CONTRACTOR'S SIGNATURE



PROSPECTIVE CONTRACTOR'S TITLE

Ramona McGroarty
Contracts and Grants Analyst

PROSPECTIVE CONTRACTOR'S USUAL BUSINESS NAME

Office of Research, University of California
410 Mrak Hall
One Shields Avenue
Davis, CA95616-8671
(530) 752-9753; FAX (530) 754-9233

**NONCOLLUSION AFFIDAVIT TO BE EXECUTED BY
BIDDER AND SUBMITTED WITH BID FOR PUBLIC WORKS**

New York
STATE OF ~~CALIFORNIA~~)
New York) ss
COUNTY OF Yoto)

James A. Cunningham
(name) , being first duly sworn, deposes and
says that he or she is Sr VP Finance & Administration of
(position title)
National Audubon Society
(the bidder)

the party making the foregoing bid that the bid is not made in the 'interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation: that the bid is genuine and not collusive or sham: that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding. that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true: and, further, that the bidder **has** not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not **pay** any fee to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a **collusive** or sham bid.,

DATED: 5/12/00

[Signature]
Subscribed and sworn to before me on

May 12, 2000

Sabita M. Sadoo
(Notary Public)

(Notarial Seal)

DWR 4206 (New 4/90)

SABITA M. SADOO
Notary Public, State of New York
No. 01SA5036825
Qualified in Queens County
Commission Expires Dec. 12, 2000

APPLICATION FOR FEDERAL ASSISTANCE

OMB Approval No. 0348-0043

		2. DATE SUBMITTED	Applicant Identifier
1. TYPE OF SUBMISSION:		3. DATE RECEIVED BY STATE	State Application Identifier
Application <input checked="" type="checkbox"/> Construction <input checked="" type="checkbox"/> Non-Construction Preapplication <input type="checkbox"/> Construction <input type="checkbox"/> Non-Construction		4. DATE RECEIVED BY FEDERAL AGENCY	Federal Identifier

5. APPLICANT INFORMATION	
Legal Name: <u>National Audubon Society</u> Address (give city, county, State, and zip code): <u>555 Audubon Place</u> <u>Sacramento CA 95825</u>	Organizational Unit: <u>California State Office</u> Name and telephone number of person to be contacted on matters involving this application (give area code): <u>Dan Taylor, Exec. Dir (916) 481-5332</u>
6. EMPLOYER IDENTIFICATION NUMBER (EIN): <u>13-11624102</u>	7. TYPE OF APPLICANT: (enter appropriate letter in box)
8. TYPE OF APPLICATION: <input type="checkbox"/> New <input checked="" type="checkbox"/> Continuation <input type="checkbox"/> Revision If Revision, enter appropriate letter(s) in box(es): <u>A</u> <u>C</u> A. Increase Award B. Decrease Award C. Increase Duration D. Decrease Duration Other (specify): _____	A. State H. Independent School Dist. <input checked="" type="checkbox"/> B. County I. State Controlled Institution of Higher Learning C. Municipal J. Private University D. Township K. Indian Tribe E. Interstate L. Individual F. Intermunicipal M. Profit Organization G. Special District N. Other (Specify) <u>non-profit org.</u>
9. NAME OF FEDERAL AGENCY: <u>U.S. Bureau of Reclamation</u>	
10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER: <u>XX-XXIX</u> TITLE: _____	11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT: <u>Willow Slough Watershed Rangeland Stewardship Program</u>
12. AREAS AFFECTED BY PROJECT (Cities, Counties, States, etc.): <u>Yolo County, California</u>	
13. PROPOSED PROJECT	14. CONGRESSIONAL DISTRICTS OF: <u>District 3, Congressman Douglas Ose</u>
Start Date: <u>4/1/01</u> Ending Date: <u>4/1/04</u> a. Applicant: <u>National Audubon Society</u>	b. Project: <u>Watershed Stewardship</u>
15. ESTIMATED FUNDING:	
a. Federal	\$ <u>1,800,668</u>
b. Applicant	\$ <u>1</u>
c. State	\$ _____
d. Local	\$ _____
e. Other	\$ _____
f. Program Income	\$ _____
g. TOTAL	\$ <u>1,800,668</u>
16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?	
a. YES THIS PREAPPLICATION/APPLICATION WAS W E AVAILABLE TO M E STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON: DATE _____ b. No. <input type="checkbox"/> PROGRAM IS NOT COVERED BY E.O. 12372 <input checked="" type="checkbox"/> OR PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW	
17. IS THE APPLICANT DELINQUENT ON ANY FEDERAL DEBT?	
<input type="checkbox"/> Yes If "Yes," attach an explanation. <input checked="" type="checkbox"/> No	
18. TO THE BEST OF MY KNOWLEDGE AND BELIEF, ALL DATA IN THIS APPLICATION/PREAPPLICATION ARE TRUE AND CORRECT, THE DOCUMENT HAS BEEN DULY AUTHORIZED BY THE GOVERNING BODY OF THE APPLICANT AND THE APPLICANT WILL COMPLY WITH THE ATTACHED ASSURANCES IF THE ASSISTANCE IS AWARDED.	
a. Type Name of Authorized Representative <u>James A. Cunningham</u>	b. Title <u>Sr VP Finance & Administration</u>
c. Telephone Number <u>(212) 979-3160</u>	d. Signature of Authorized Representative <u>James A. Cunningham</u>
e. Date Signed <u>5-12-03</u>	

Previous Edition Usable

Authorized for Local Reproduction

Standard Form 424 (Rev. 7-97)

Prescribed by OMB Circular A-102

BUDGET INFORMATION- Non-Construction Programs

OMB Approval No. 0348-0044

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. Landowner Outreach		\$ 24,200	\$	\$	\$	\$
2. Implementation of Activities		460,814				
3. Research & Monitoring		746,078				
4. Program Management		569,576				
5. Totals		\$ 1,800,668	\$	\$	\$	\$

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1) Outreach	(2) Implementation	(3) Research	(4) Management	
a. Personnel	\$	\$	\$	\$ 351,520	\$
b. Fringe Benefits				123,032	
c. Travel	2,400			12,000	
d. Equipment			2,500	7,000	
e. Supplies	17,000	245,574	7,500		
f. Contractual	3,000	173,348	644,917	24,880	
g. Construction					
h. Other	1,800	41,892	91,161	51,144	
i. Total Direct Charges (sum of 6a-6h)	24,200	460,814	746,078	569,576	
j. Indirect Charges					
k. TOTALS (sum of 6i and 6j)	\$ 24,200	\$ 460,814	\$ 746,078	\$ 569,576	\$
7. Program Income	\$	\$	\$	\$	\$

Authorized for Local Reproduction

Standard Form 424A (Rev. 7-97)
Prescribed by OMB Circular A-102

SECTION C - NON-FEDERAL RESOURCES				
(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8.	\$	\$	\$	\$
9.				
10.				
11.				
12. TOTAL (sum of lines 8-11)	\$	\$	\$	\$

SECTION D - FORECASTED CASH NEEDS					
	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	\$ 544,652	\$ 136,163	\$ 136,163	\$ 136,163	\$ 136,163
14. Non-Federal					
15. TOTAL (sum of lines 13 and 14)	\$	\$	\$	\$	\$

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT				
(a) Grant Program	FUTURE FUNDING PERIODS (Years)			
	(b) First	(c) Second	(d) Third	(e) Fourth
16. Watershed Stewardship	\$ 544,652	\$ 657,843	\$ 598,173	\$
17.				
18.				
19.				
20. TOTAL (sum of lines 16-19)	\$ 544,652	\$ 657,843	\$ 598,173	\$

SECTION F - OTHER BUDGET INFORMATION	
21. Direct Charges:	22. Indirect Charges:
23. Remarks:	

ASSURANCES - NON-CONSTRUCTION PROGRAMS

Public reporting burden for this collection of information is estimated to average 15 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0040), Washington, DC 20503.

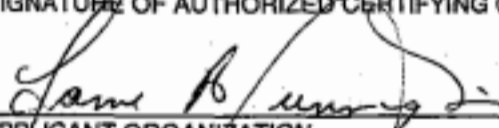
PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET. SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.

NOTE Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the awarding agency. Further, certain Federal awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant, I certify that the applicant:

1. Has the legal authority to apply for Federal assistance and the institutional, managerial and financial capability (including funds sufficient to pay the non-Federal share of project cost) to ensure proper planning, management and completion of the project described in this application.
2. ~~Will~~ give the awarding agency, the Comptroller General of the United States and, if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the award: and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.
3. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.
4. Will initiate and complete the work within the applicable time frame after receipt of approval ~~of~~ the awarding agency.
5. Will comply with the Intergovernmental Personnel Act of 1970 (42 U.S.C. §§4728-4763) relating to prescribed standards for merit systems for programs funded under one of the 19 statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5 C.F.R. 900, Subpart F).
6. Will comply with all Federal statutes relating to nondiscrimination. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, ~~as~~ amended (20 U.S.C. §§1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. §794), which prohibits discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, ~~as~~ amended (42 U.S.C. §§6101-6107), which prohibits discrimination on the basis of age; (e) the Drug Abuse Office and Treatment Act of 1972 (P.L. 92-255), as amended, relating to nondiscrimination on the basis of drug abuse; ~~(9)~~ the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91-616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) §§523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. 5529d-3 and 290e-3), ~~as~~ amended, relating to confidentiality of alcohol and drug abuse patient records; (h) Title VIII of the Civil Rights Act of 1968 (42 U.S.C. 5513 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing; (i) any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made: and, ~~(j)~~ the requirements of any other nondiscrimination statute(s) which may apply to the application.
7. Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provide for fair and equitable treatment of persons displaced or whose property is acquired ~~as~~ a result of Federal or federally-assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.
8. Will comply, ~~as~~ applicable, with provisions of the Hatch Act (5 U.S.C. §§1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

9. **VI** comply, as applicable, with the provisions of the Davis-Bacon Act (40 U.S.C. §§276a to 276a-7), the Copeland Act (40 U.S.C. §276c and 18 U.S.C. §874), and the Contract Work Hours and Safety Standards Act (40 U.S.C. §§327-333), regarding labor standards for federally-assisted construction subagreements.
10. **VI** comply, if applicable, with flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (P.L. 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total **cost** of insurable construction and acquisition is \$10,000 or more.
11. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the National Environmental Policy Act of 1969 (P.L. 91-190) and Executive Order (**EO**) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to **EO** 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§1451 et seq.); (f) conformity of Federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 U.S.C. §§7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended (P.L. 93-523); and, (h) protection of endangered species under the Endangered Species Act of 1973, as amended (P.L. 93-205).
12. Will comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. §§1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.
13. Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. §470), EO 11593 (identification and protection of historic properties), and the Archaeological and Historic Preservation Act of 1974 (16 U.S.C. §§469a-1 et seq.).
14. Will comply with P.L. 93-348 regarding the protection of human subjects involved in research, development, and related activities supported by this award of assistance.
15. Will comply with the Laboratory Animal Welfare Act of 1966 (P.L. 89-544, as amended, 7 U.S.C. §§2131 et seq.) pertaining to the care, handling, and treatment of warm blooded animals held for research, teaching, or other activities supported by this award of assistance.
16. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. §§4801 et seq.) which prohibits the use of lead-based paint in construction or rehabilitation of residence structures.
17. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act Amendments of 1996 and OMB Circular No. A-133, "Audits of States, Local Governments, and Non-Profit Organizations."
18. Will comply with all applicable requirements of all other Federal laws, executive orders, regulations, and policies governing this program.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL 	TITLE Sr VP Finance & Administration
APPLICANT ORGANIZATION National Audubon Society	DATE SUBMITTED 5-12-00

BUDGET INFORMATION - Construction Programs

NOTE: Certain Federal assistance programs require additional computations to arrive at the Federal share of project costs eligible for participation. If such is the case, you will be notified.

COST CLASSIFICATION	a. Total Cost	b. Costs Not Allowable for Participation	c. Total Allowable Costs (Columns a-b)
1. Administrative and legal expenses	\$ 400 .00	\$.00	\$ 400 .00
2. Land, structures, rights-of-way, appraisals, etc.	\$.00	\$.00	\$.00
3. Relocation expenses and payments	\$.00	\$.00	\$.00
4. Architectural and engineering fees	\$ 400 .00	\$.00	\$ 400 .00
5. Other architectural and engineering fees	\$.00	\$.00	\$.00
6. Project inspection fees	\$.00	\$.00	\$.00
7. Site work	\$ 400 .00	\$.00	\$ 400 .00
8. Demolition and removal	\$.00	\$.00	\$.00
9. Construction	\$ 4000 .00	\$.00	\$ 4000 .00
10. Equipment	\$.00	\$.00	\$.00
11. Miscellaneous	\$.00	\$.00	\$.00
12. SUBTOTAL (sum of lines 1-11)	\$ 5,200 .00	\$.00	\$ 5,200 .00
13. Contingencies	\$.00	\$.00	\$.00
14. SUBTOTAL	\$.00	\$.00	\$.00
15. Project (program) income	\$.00	\$.00	\$.00
16. TOTAL PROJECT COSTS (subtract #15 from #14)	\$ 5,200 .00	\$.00	\$ 5,200 .00
FEDERAL FUNDING			
17. Federal assistance requested, calculate as follows: (Consult Federal agency for Federal percentage share.) Enter the resulting Federal share.	Enter eligible costs from line 16c Multiply X <u>100</u> %		\$ 5,200 .00

ASSURANCES -CONSTRUCTION PROGRAMS

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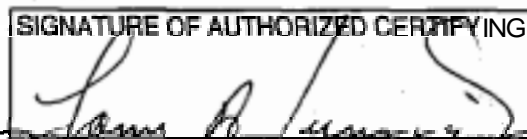
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NOTE: Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the Awarding Agency. Further, certain Federal assistance awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant, I certify that the applicant:

1. Has the legal authority to apply for Federal assistance, and the institutional, managerial and financial capability (including funds sufficient to pay the non-Federal share of project costs) to ensure proper planning, management and completion of the project described in this application.
2. Will give the awarding agency, the Comptroller General of the United States and, if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the assistance; and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.
3. Will not dispose of, modify the use of, or change the terms of the real property title, or other interest in the site and facilities, without permission and instructions from the awarding agency. Will record the Federal interest in the title of real property in accordance with awarding agency directives and will ~~into~~ **include** a covenant in the title of real property acquired in whole or in part with Federal assistance funds to assure non-discrimination during the useful life of the project.
4. Will comply with the requirements of the assistance awarding agency with regard to the drafting, review and approval of construction plans and specifications.
5. Will provide and maintain competent and adequate engineering supervision at the construction site to ensure that the complete work conforms with the approved plans and specifications and will furnish progress reports and such other information as may be required by the assistance awarding agency or State.
6. Will initiate and complete the work within the applicable time frame after receipt of approval of the awarding agency.
7. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.
8. Will comply with the Intergovernmental Personnel Act of 1970 (42 U.S.C. §§4728-4763) relating to prescribed standards for merit systems for programs funded under one of the 19 statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5 C.F.R. 900, Subpart F).
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11. Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provide for fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal and federally-assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.
12. Will comply with the provisions of the Hatch Act (5 U.S.C. §§1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.
13. Will comply, ~~as~~ applicable, with the provisions of the Davis-Bacon Act (40 U.S.C. ~~§§276a to 276a-7~~), the Copeland Act (40 U.S.C. §276c and 18 U.S.C. §874), and the Contract Work **Hours** and Safety Standards Act (40 U.S.C. §§327-333) regarding labor standards for federally-assisted construction subagreements.
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15. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the National Environmental Policy Act of 1969 (P.L. 91-190) and Executive Order (EO) 11514: (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§1451 et seq.); (f) conformity of Federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 U.S.C. §§7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended (P.L. 93-523); and (h) protection of endangered species under the Endangered Species Act of 1973, as amended (P.L. 93-205).
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18. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act Amendments of 1996 and OMB Circular No. A-133, 'Audits of States, Local Governments, and Non-Profit Organizations.'
19. Will comply with all applicable requirements of all other Federal laws, executive orders, regulations, and policies governing this program.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL 	TITLE Sr VP Finance & Administration
APPLICANT ORGANIZATION National Archivist Society	DATE SUBMITTED 5-12-00

Appendix 5. Literature Cited

- Anderson, J. H. 1999. Direct seeding of California native grasses in the Sacramento Valley and foothills. In *Bring farm edges back to life!*, Woodland, CA Yolo County Resource Conservation District.
- Barrows, C., G. Hinshaw, and L. Miller. 1998. Using fire as a tool in natural lands management. *Perpetuity* 8(1): 1-7.
- Belsky, A. Matzke, and S. Usselman. 1999. Survey of livestock influences on stream and riparian ecosystems in the western United States. *Journal of Soil and Water Conservation* 54(1): 419-431.
- Brown CS, Rice KJ. 2000. The mark of zorro: Effects of the exotic annual grass *Vulpia myuros* on California native perennial grasses. *Restor Ecol* 8:10-17.
- CALFED Bay-Delta Program. Ecosystem restoration projects and programs, 2001 Proposal Solicitation Package.
- CALFED Bay-Delta Program. Ecosystem Restoration Program Plan (ERPP), Vols. 1 and 2. June 1999.
- Chaney, E., W. Elmore, and W.S. Platts. 1993. Management change: livestock grazing on western riparian areas. Eagle Rock, ID: Northwest Resource Information Center, Inc. for the U.S. Environmental Protection Agency, Region 8.
- Cheater, M. 1995. Good guys in the Badlands. *The Nature Conservancy*, July/August 1995.
- DiTomaso, J.M., Kyser, G.B., & Hastings, M.S. 1999. Prescribed burning for control of yellow starthistle (*Centaurea solstitialis*) and enhanced native plant diversity. *Weed Sci.* 47: 233-242.
- Hatch DA, Bartolome JW, Fehmi JS, et al. 1999. Effects of burning and grazing on a coastal California grassland. *Restor Ecol* 7: 376-381.
- Hopkinson, P. Fehmi, J. S., and J.W. Bartolome. 1999. Summer burns reduce cover but not spread of barbed goat grass in California grassland. *Ecological Restoration* 17(3): 168-169.
- Jones & Stokes Associates, Inc. Final. Willow Slough watershed integrated resources management plan. May 1996. (JSA 95-232) Sacramento, CA. Prepared for Yolo County Resource Conservation District, Woodland, CA.
- Macon, D. 2000. Grazing for change: range and watershed management success stories in California. California Cattleman's Association.
- Menke, J. W. 1980. Grazing and fire management for native perennial grass restoration in California grasslands. *Fremontia* 20(2): 22-25.
- Page, J. 1997. Ranchers form a 'radical center' to protect wide-open spaces. *Smithsonian* (June 1997).
- Qi, J. Y. H. Kerr, M. S. Moran, M. Weltz, A. R. Huete, S. Sorooshian, and R. Bryant. 2000 Leaf area index estimates using remotely sensed data and BRDF models in a semi arid region, *Remote Sensing of Environment*.
- Soil Conservation Service (SCS). Summary Report, 1987. National Resources Inventory. Washington D.C.: SCS.
- Srait, D. 1999. Native grasses and their value for wildlife habitat enhancement. *Grasslands* 9 (2): 1-13.

- Ter Braak, C.J.F. 1996. Unimodal models to relate species to environment. Agricultural Mathematics Group. Wageningen, Netherlands
- The Nature Conservancy. 1999. Using prescribed fire as a vegetation management tool. Workshop cosponsored by the California Native Grass Association, Yolo County RCD, and Audubon-California, Winters, CA. October 20-21, 1999.
- United States Department of the Interior (USDI). 1994. Rangeland reform '94: draft environmental impact statement. Bureau of Land Management, Washington D.C.
- United States Department of the Interior (USDI). 1997. Riparian area management. Bureau of Land Management, United States Department of the Interior (USDI). 1997. Riparian area management. Bureau of Land Management, Denver, CO, Technical Reference 1737-14.
- Wirka, J. W. 1999. The state of the art: prescribed burning in California grasslands. *Grasslands* 9(3): 1-8.
- Wirka, J. W. 2000. Quality Assurance Project Plan (QAPP), Union School Slough Watershed Improvement Program (Calfed grant #98-#13), National Audubon Society, CA.
- Wood, M. 2000. Hardy natives at home on the U.S. range. *Agricultural Research* (April 2000) 4-7.
- Wrysinski, J. P. Robins, and G. Verseart. 1998. Native grass forage quality pilot study. *Grasslands* 8(2).
- Yolo County Resource Conservation District. 1999. Bring farm edges back to life!, Woodland, CA.

Note: Additional references providing scientific background and justification, research protocols, and data collection and analytical methods are provided in individual research subcontract proposals included in Appendix 2.

Appendix 6.

Threshold Requirements

A. Letters of Notification to Yolo County

B. Environmental Compliance Checklist

C. Land Use Checklist

National Audubon Society—California

May 12, 2000

Lois Wolk, Chairman
Yolo County Board of Supervisors
625 Court St
Woodland CA 95695

The National Audubon Society – California State Office is pleased to notify you that we are submitting the enclosed proposal entitled “The Willow Slough Watershed Rangeland Stewardship Program” to CALFED Bay-Delta Program.

This proposed program is a second-phase request within our collaborative partnership with the Yolo County Resources Conservation District as part of our existing CALFED project, “The Union School Slough Watershed Improvement Program,” now in its second year. Requested funds are for direct implementation of the Willow Slough Integrated Resource Management Plan (which the County helped fund in 1996). This next phase of our program would include three primary tasks:

- 1) Providing outreach, training, and conservation project planning assistance to private ranchland owners in the upper watershed of Willow Slough;
- 2) Implementing a series of conservation activities with ranchland owners, including riparian and grassland habitat enhancements; and
- 3) Conducting research and monitoring of ranchland conservation practices to assess their contribution to watershed health.

The program involves new partners, including USDA Agricultural Research Service, UC Davis’ Departments of Agronomy and Range Science, Wildlife, Fish and Conservation Biology, and Environmental Horticulture. Each brings to the project scientific expertise to assist with research and monitoring tasks.

Already the proposal enjoys the support of the Yolo RCD, NRCS Woodland Field Office, the Yolo County Farm Bureau, and a number of enthusiastic ranchland owners. If funded, this program would be closely coordinated with a program being proposed by the Yolo RCD, also under the CALFED Bay-Delta Program.

Please contact me if you would like any further information or have questions regarding our proposal.

Sincerely,


Judy Boshoven

Watershed Coordinator
Audubon California
C/O Yolo County RCD
221 West Court Street
Woodland, CA 95695

Cc: Clerk of the Board



May 12,2000

John Bencomo, Director
292 West Beamer Street
Woodland, CA 95695

The National Audubon Society - California State Office is pleased to notify you that we are submitting the enclosed proposal entitled "The Willow Slough Watershed Rangeland Stewardship Program" to CALFED Bay-Delta Program.

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- 3) Conducting research and monitoring of ranchland conservation practices to assess their contribution to watershed health.

The program includes new partners, USDA Agricultural Research Service, UCD's Rangeland Sciences, Wildlife, Fish, and Conservation Biology, and Environmental Horticulture Departments. Each brings to the project scientific evaluation skills to assist with research and monitoring tasks.

If funded, his program would be closely coordinated with a program being proposed by the Yolo RCD, also under the CALFED Bay-Delta Program. Already the proposal enjoys the support of the Yolo RCD, NRCS Woodland Field Office, the Yolo County Farm Bureau, and a number of enthusiastic ranchland owners.

Please contact me if you would like any further information or have questions regarding our proposal.

Sincerely,

A handwritten signature in dark ink, appearing to read "Judy Boshoven".

Judy Boshoven
Watershed Coordinator
Audubon California
C/O Yolo County RCD
221 West Court Street
Woodland. CA 95695

Cc: Clerk of the Board

Environmental Compliance Checklist

1. Do any **of** the actions included in the proposal require compliance with either the California Environmental Quality Act (CEQA), the National Environmental Policy Act (NEPA), **or** both?

<u> </u>	Y
YES	NO

2. If you answered yes to # 1, identify the lead governmental agency for CEQA/NEPA compliance. (No to #1)

Lead Agency

3. If you answered no to # 1, explain why CEQA/ NEPA compliance is not required for the actions in the proposal. It is not anticipated activities proposed as part of the project would be considered discretionary actions by local, state or federal agencies.

4. If CEQA/NEPA compliance is required, describe how the project will comply with either **or** both of these laws. Describe where the project is in the compliance process and the expected date of completion. It is not anticipated that CEQA/NEPA compliance will be required.

5. Will the applicant require access across public **or private property that the applicant does not own to accomplish the activities in the proposal?**

X	
YES	NO

Audubon will require access across private property that we do not own to accomplish the activities in the proposal. Because individual properties where project activities will be implemented have not yet been identified, Audubon will provide access needs and permission for access from individual private landowners within 30 days of notification of approval.

6. Please indicate what permits **or** other approvals may be required for the activities contained in your proposal. Check all boxes that apply.

LOCAL

Conditional use permit _____

Variance_____

Subdivision Map Act approval _____

Grading permit _____

General plan amendment

Specific plan approval_____

Rezone _____

Williamson Act Contract cancellation _____

Other _____

(please specify)
None required **X**

STATE

CESA Compliance ____ (CDFG)
Streambed alteration permit ____ (CDFG)
CWA § 401 certification ____ (RWQCB)
Coastal development permit ____ (Coastal Commission/BCDC)
Reclamation Board approval ____
Notification ____ (DPC, BCDC)
Other _____

(please specify)
None required **X**

FEDERAL

ESA Consultation ____ (USFWS)
Rivers & Harbors Act permit ____ (ACOE)
CWA § 404 permit ____ (ACOE)
Other _____

(please specify)
None required **X**

DPC = Delta Protection Commission

CWA = Clean Water Act ESA = Endangered Species Act

CESA = California Endangered Species Act CDFG = California Department of Fish and Game

USFWS = U.S. Fish and Wildlife Service RWQCB = Regional Water Quality Control Board

ACOE = U.S. Army Corps of Engineers BCDC = Bay Conservation and Development comm.

Land Use Checklist

1. Do the actions in the proposal involve physical changes to the land (i.e. grading, planting vegetation, **or** breaching levees) **or** restrictions in land use (i. e. conservation easement **or** placement of land in a wildlife refuge)?

X

YES

NO

2. If NO to # 1, explain what type of actions are involved in the proposal (i.e., research only, planning only). (no to # 1)

3. If YES to # 1, what is the proposed land use change **or** restriction under the proposal? The project will not require land use changes **or** restrictions. Physical changes to the land (i.e. erecting fences, planting vegetation, prescribed burning) are compatible with current private rangeland land uses.

4. If YES to # 1, is the land currently under a Williamson Act contract?

X

YES

NO

5. If YES to # 1, answer the following:

Current land use: Private rangeland or Conservation Reserve Program properties

Current zoning: Agriculture Preserve (A-P) and General Agriculture (A-1)

Current general plan designation: Agriculture

6. If YES to #1, is the land classified as Prime Farmland, Farmland of Statewide Importance **or** Unique Farmland on the Department of Conservation Important Farmland Maps?

X

YES

NO

DON'T KNOW

7. If YES to # 1, how many acres of land will be subject to physical change **or** land use restrictions under **the** proposal? All project areas in the watershed that will be subject to physical change (i.e. erecting fences, planting vegetation, prescribed burning) have not been identified. However, projects will be compatible with current private rangeland uses, and will not require land use restrictions.

8. If YES to # 1, is the property currently being commercially farmed **or** grazed?

X

YES

NO

9. If YES to #8, what is the number of employees/acre? Because individual private properties where project activities will be implemented within the watershed have not yet been identified, we cannot provide **an** accurate response to this question. The total number of employees? Again, because individual private properties where project

activities will be implemented within the watershed have not yet been identified, we cannot provide an accurate response to this question.

10. Will the applicant acquire any interest in land under the proposal (fee title or a conservation easement)?

 X
YES NO

11. What entity/organization will hold the interest? Private landowners would continue to hold the interest in their property.

12. If **YES** to # 10, answer the following: (No to # 10)

Total number of acres to be acquired under proposal _____

Number of acres to be acquired in fee _____

Number of acres to be subject to conservation easement _____

13. For all proposals involving physical changes to the land **or** restriction in land use, describe what entity or organization will:

manage the property: Private landowners would continue to manage their property. However, Audubon will coordinate with landowners on management of individual project sites.

provide operations and maintenance services: Private landowners would provide operations and maintenance services for project on their property.

conduct monitoring: Audubon and other collaborating agencies and organizations will conduct monitoring with approval and participation by the private landowner.

14. For land acquisitions (fee title **or** easements), will existing water rights also be acquired? (No land acquisition is proposed)

YES NO

15. Does the applicant propose any modifications to the water right or change in the delivery of the water?

 X
YES NO

16. If **YES** to # 15, describe: (no to #15)